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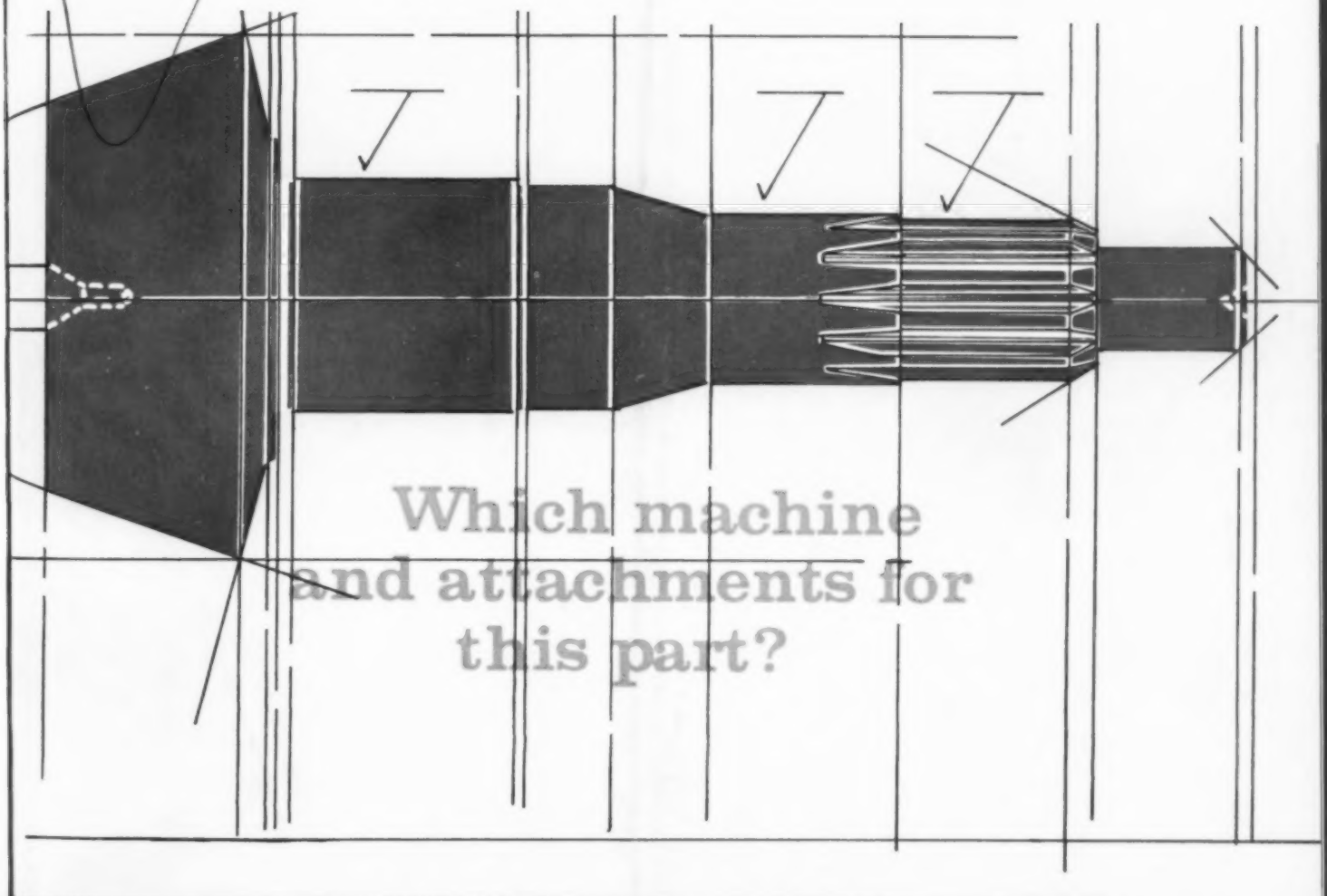

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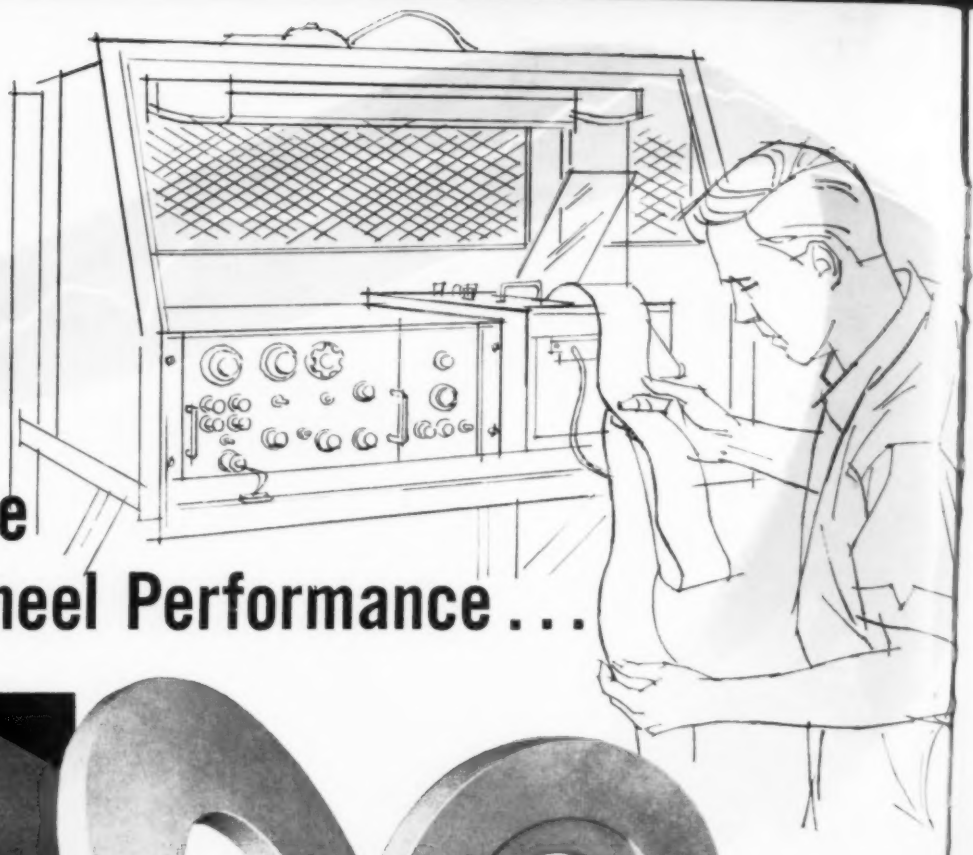
HEAT COOLANTS?

CENTERLESS: HIGH PRODUCTION OD GRINDING

PART II—MACHINES, ACCESSORIES, ATTACHMENTS



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DYNAMIC WHEEL HARDNESS TESTING is a grinding wheel development important to you in meeting production demands for high speed grinding of new and improved metals . . . close dimensional tolerances . . . and high finish. All require grinding wheels built for the job. And, the hardness and uniformity of the wheel *over its entire cutting surface* is important in obtaining grinding efficiency and good surface finish.

Macklin's "Dyna-Graded" electronic wheel testing method crushes minute amounts of abrasive from the entire cutting surface of the *running* wheel. Forces required to crush the abrasive particles are recorded on a tape to record any significant variation which could affect wheel performance.

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MACKLIN company Jackson, Michigan

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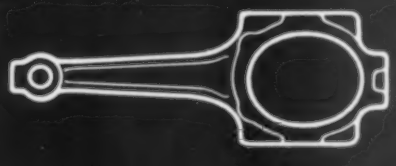
Dept. 63

BK bond discs

ELIMINATE BURNING

Gardner cooler-cutting BK discs grind connecting rods without burning or work hardening—raise hourly output by 30%



production data

part	connecting rods
machine	Mattison vertical spindle grinder
rate	455 parts per hr.
(former rate	350 parts per hr.)
stock removal:	
rough	.010"-.015"
finish	.005"-.010"

GARDNER

abrasive discs

GARDNER MACHINE COMPANY, BELOIT, WISCONSIN

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THE DIA-CROWN LINE...

with the first really new bond in all diamond wheel history!

...B-56, an unparalleled advancement for all carbide grinding ...wet and dry

Since Norton Company developed the first diamond wheels for industry in 1929 it has been the leader in diamond wheel progress — first the resinoid bond, then the metal and vitrified bonds.

Now comes another "first" from Norton, a brand-new bond, the B-56, an outstanding development combining greater productivity and economy for either wet or dry carbide grinding in ONE bond — providing the finest diamond wheels, the Dia-Crown line, ever produced for tool sharpening, die grinding and all other carbide toolroom or production jobs.

In test after test on the widest range of carbide grinding, wet and dry, in customers' plants, Norton Dia-Crown B-56 wheels have outperformed all other wheels with major results — per job — including the following:

- Increased volume of carbide removed, per unit of time.
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"*Wheel was so good we could hardly believe it, and checked test results again . . . still showed 30% longer wheel life.*"

"*This wheel reduced grinding costs from 13¢ to 7¢ per tip.*"

"*An extremely fine wheel. Cuts more carbide in a given time than any other wheel.*"

"*Best wheel ever used. Will convert to this for all our diamond wheel operations.*"

That's what our customers say — and it's due to this entirely new Norton resinoid bond — a truly outstanding development. Norton Dia-Crown wheels with this new bond are available in all types and sizes for carbide grinding. Remember, too, that if two wheels of the same size and type have been required for wet and dry grinding — this ONE new wheel will now do both — wet *or* dry, reducing inventories and cutting costs.

Get complete facts on how this new Dia-Crown line of diamond wheels can improve your carbide grinding and save you time and money. See your Norton Man, a trained Abrasive Specialist, or your Norton Distributor. NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

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Case in point:

In a production test involving electrolytic grinding of more than 311,000 miscellaneous carbide tools, 6 wheels with G-E Man-Made diamond were compared with 6 wheels containing natural diamond.

ELECTROLYTIC GRINDING PERFORMANCE				
Diamond Type	Average Wheel Wear Inches	Average Cubic Inches Carbide Removed	Avg. Cu. In. Carbide Removed Per Cu. In. Wheel Wear	Efficiency Ratio
G-E MBG	.0605	90.885	70.2	122.5
Natural	.0644	80.181	57.3	100.0

Results: *a 22.5% superiority for G-E Man-Made diamond over natural diamond!*

Let your own tests validate the benefits of G-E Man-Made diamond in your metal-bond grinding operations. You'll find *the payoff is performance.* Call your wheel supplier soon.

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- The Fourth Annual STATE OF THE INDUSTRY
- Centerless Grinding, Part III: Wheels, Coolants, Dressing and Truing
- The Groove in the Swing Is Ground

Grinding and Finishing

For Better Production and Finishing with Abrasives

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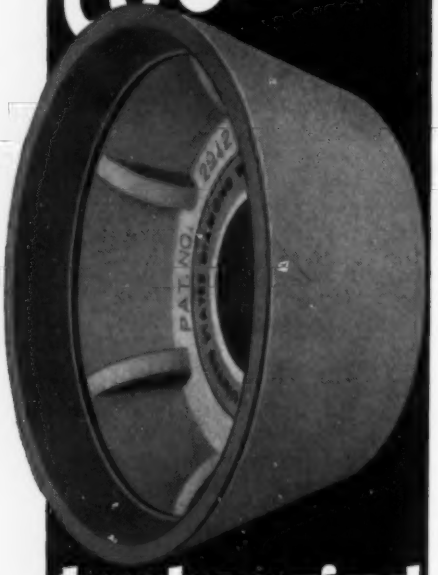

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Editor's Mail

VERTEBRA MISSING

Your editorial in the September issue of GRINDING and FINISHING is to my mind well taken.

I should like to point out, however, from my own experience, that the University of Illinois offers courses in both theory and practice of metal cutting. I hold an M. S. in mechanical engineering from that school and did my thesis as well as course work on metal cutting subjects.

If grinding was neglected it was because industry (the grinding industry in particular) has made little effort to encourage the teaching of abrasive processes. To my knowledge they have certainly offered little help financially or in equipment to make course or research work of this nature possible.

Morton Jackson

The editorial in question was prompted by the receipt of two compilations, one from Japan and the other from Russia, which indicated a great deal more research in abrasives than has come to the editor's attention from universities in this country.

Occasional abrasive symposiums at Alfred University (G&F, August, 1959) and several scattered research projects (plus, of course, research sponsored by manufacturers' associations) are as much as comes readily to mind.

If there is more course or research work going on than has been generally reported, it would be a pleasure to publish a note on the matter.

ABRASIVE ENGINEER'S CORNER—ROLL GRINDING WITH BELTS

Your reply to an Oslo, Norway, correspondent who was interested in grinding paper making rolls with abrasive belts (G&F, January, '61) indicated a lack of faith in the ability of the belt to perform the task. As we have achieved considerable success with roll grinding, we are taking the opportunity you offered of "pleading a case" for the coated abrasive belt method.

Several years ago, we were able to convince the engineers at Whakatane Board Mills in New Zealand that converting their grinding wheel rig to abrasive belt operation for grinding and polishing the 12′ 6″ diameter x 10′ 6″ wide master glazing cylinder had some merit. In spite of initial problems, the results were sufficiently successful for Whakatane's chief engineer to publicise and recommend the method during a subsequent visit to Australia.

In the ensuing years practically every paper mill in this country has converted their grinding equipment to operate with belts and the method has now become the accepted one for master glazing cylinder reconditoning.

We realize that this is a special case—that master glazing cylinders represent only a small portion of roll grinding by a paper or board mill, but the abrasives belt has permitted a job to be completed in almost half the period required with a grinding wheel. Finish is also superior.

We don't want to convey the impression that belts are the complete answer to roll grinding needs. Nevertheless, we are positive that they offer some advantages over wheels for many roll grinding applications.

If you think it worthwhile we can prepare an article containing roll grinding case studies and photos. . . .

We would welcome the opportunity of providing an article for we have applied much of the information publicised by you and we would like to reciprocate by adding our experiences to the common pool of knowledge generated by GRINDING and FINISHING.

B. R. McDivitt
Product Engineering Manager
Behr-Manning (Aust.) Pty. Ltd.

Such an article should be most worthwhile, and we have so informed Mr. McDivitt, along with our regrets that space did not permit printing his letter in full. A copy of his reply has been forwarded to the Oslo reader making the original inquiry.

CIMPERIAL SOLVES GRINDING ROOM PROBLEMS

for parts manufacturer. Another success story for versatile CIMPERIAL, heavy duty cutting fluid of famous CIMCOOL line.

(Company name on request.)

FIELD SERVICE REPORT

and in their grinding department they had all kinds of trouble with the coolant which fed to each machine from a 3,000 gallon central system.

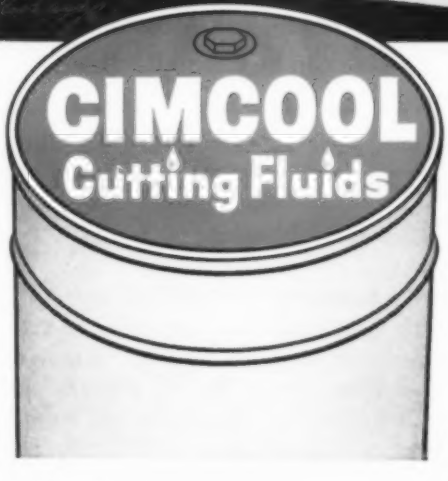
The coolant they were using got dirty and loaded up with grit. It didn't have enough lubricity to give them a good finish. Also, they experienced line clogging, rust and rancidity.

We installed Cimperial at 100-to-1. Right away their finish cleared up. The coolant lines stayed open. No rust or rancidity at all.

And with Cimperial they find they are getting 10 to 15% more pieces with each dressing of the wheel. They sure are happy with that boost in production on top of the other performance improvements.

Bob Hancock

Cleveland Office



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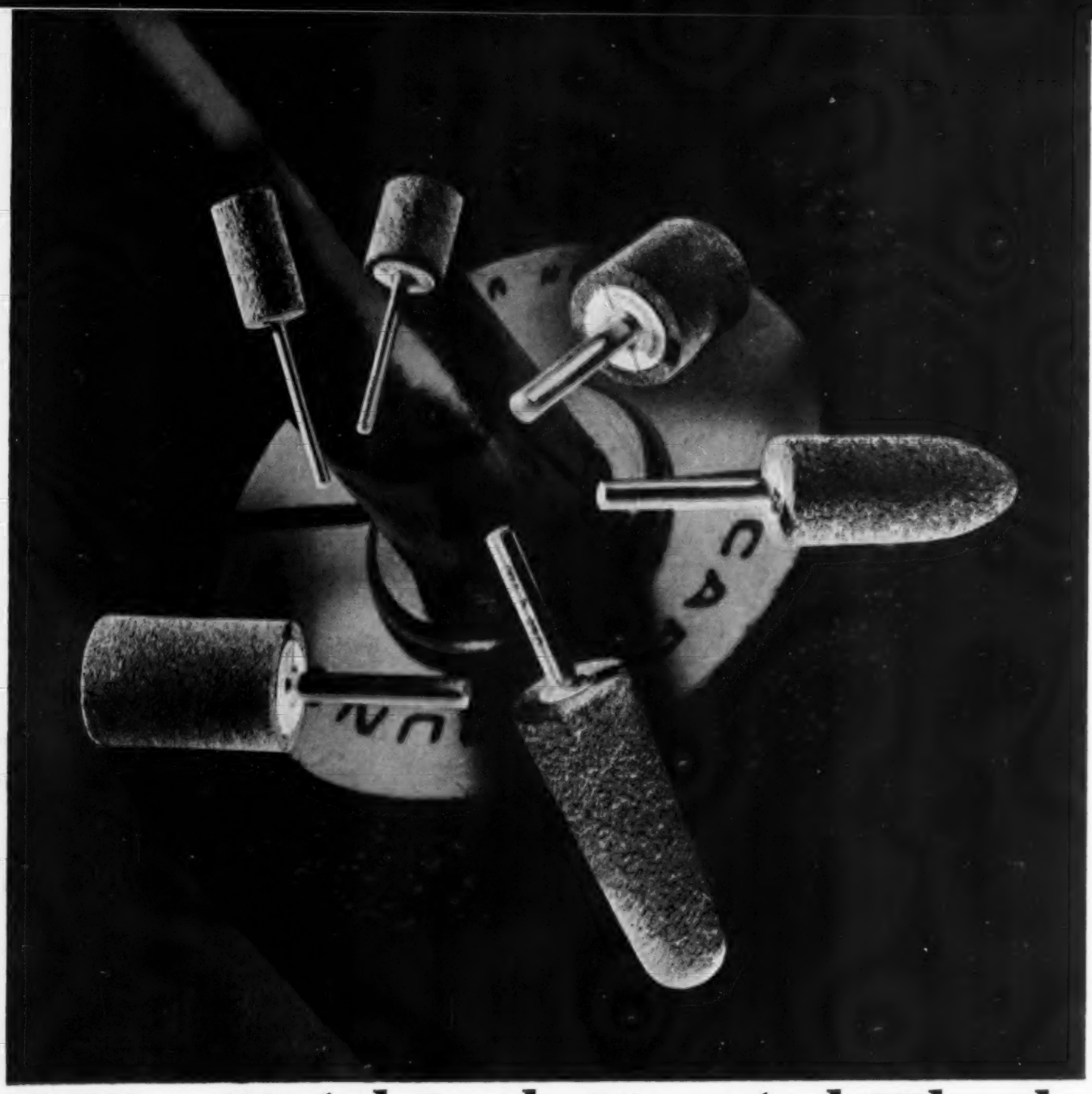

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... extra strength for trouble-free portable grinding

Mandrel failure, wheel breakage and fly-off is reduced to a minimum with Carborundum's new Metal-Lock Mounted Wheels. With mandrels actually metal-fused to the abrasive, the Metal-Lock Mounted Wheels withstand extreme heat and vibration on the roughest of grinds. The abrasive can be used effectively right down to the mandrel. Clean, even metal mounting also assures precise balance in every wheel. Carborundum's Metal-Lock Wheels are identified by the new red and white blotter... call your Carborundum distributor for a demonstration. Bonded Abrasives Division, Niagara Falls, N. Y. CARBORUNDUM

METAL-LOCK MOUNTING. Die-cast metal in molten stage is injected into wheel under pressure, fusing it to the abrasive grain (circle) to produce this new more durable mandrel bond.

TORTURE TEST PROVES STRENGTH. Metal-Lock Mounted Wheels were subjected to a series of torque stress tests in Carborundum Laboratories. In each test, at point of maximum stress, the ¼" stainless steel mandrels snapped off before there was any evidence of yielding between mandrel bond and wheel.

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Dateline: Industry's Economy

1962 will be a year of limited, but solid, gains, with a possible drop-off in the fourth quarter and with over-all price increases of not more than 2%, according to the concensus of business forecasters. While business has not always followed this "standard forecast," the trend has been in that direction. Gross national product would be in the vicinity of $560 billion, 7% above 1961, and a solid 5% increase with allowance for price rises.

Rough diamond sales by the Central Selling Organization, London, set records for both the third quarter and for the first nine months of a year. For the quarter, sales were $65 million, up about $200,000 from 1959's previous record. For the nine months, it was approximately $194 million against 1959's $191.5 million. The Central Selling Organization markets about 90% of African diamond production for both industrial and gem uses.

Whether the announced fifteen- and twelve-year write-offs for textile machinery foreshadow a shortened depreciation allowance for all manufacturing machinery and equipment is a question engaging the attention of the entire business community. Accelerated tax depreciation has been favored by industry spokesmen as the simplest plan to enable this country to meet European competition in depreciation provisions. The change for textiles, the announcement specified, was made to enable an ailing industry to meet foreign competition.

Only within the last few months have inventories begun to reflect the gradual rise in business. The explanation is simple: manufacturers have been working off finished goods faster than their rate of production. With the slack pretty much taken up, shipments should have a much more immediate effect on demands for raw materials.

Price increases on grinding machines described as ranging from "across the board" to "selective," following a period of stability, have been instituted by some builders within the past few weeks. Others are reported to be reviewing their price structures, while a third group are either non-committal or else definitely stand-pat. Announced increases included one of about 7½% by Norton Co. on foreign shipments; others in a similar range for all Landis Tool grinders and for surface and cylindrical grinders by Parker-Majestic; an across-the-board rise of 3% by Thompson, unspecified changes by Gallmeyer-Livingston, Mattison, and R-O Manufacturing.

Great Britain continues to stand on the edge of the Common Market pool, sticking an occasional toe into the water to test its temperature, but not taking the plunge. British machine tool builders are reported highly in favor, feeling they have more to gain by the opening of new continental markets than they have to lose by the invasion of Britain by Common Market manufacturers unhampered by tariffs. With expected shrinkage of the traditional 50% to Commonwealth nations which are no longer under the Empire umbrella, the British look elsewhere, and the Continent apparently looks good.

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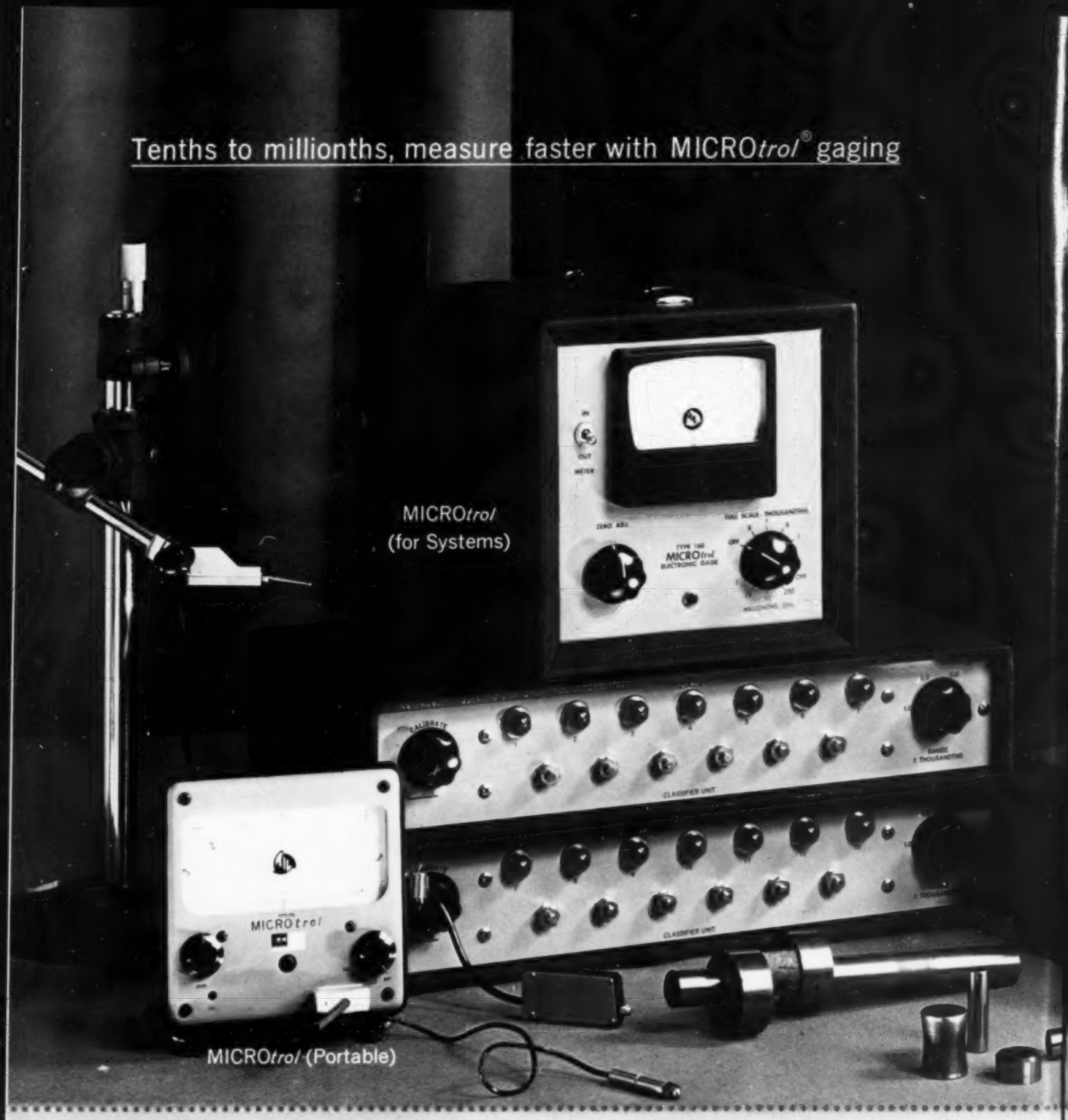

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It's rugged and lightweight because it's transistorized. Four interchangeable gage heads readily cover the whole range of normal gaging setups.

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With accessories you can get automatic inspection, automatic sorting, or complete closed-loop control.

FEATURES: 4 scale ranges available. Repeatability to 0.000005". High stability and reliability. Comparator systems from $764.

Now with new motor drive Transistorized METRO*surf* Type 180 measures surface roughness at less cost

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It's fast. It's portable. You can use it at machine or bench. Battery or a models available.

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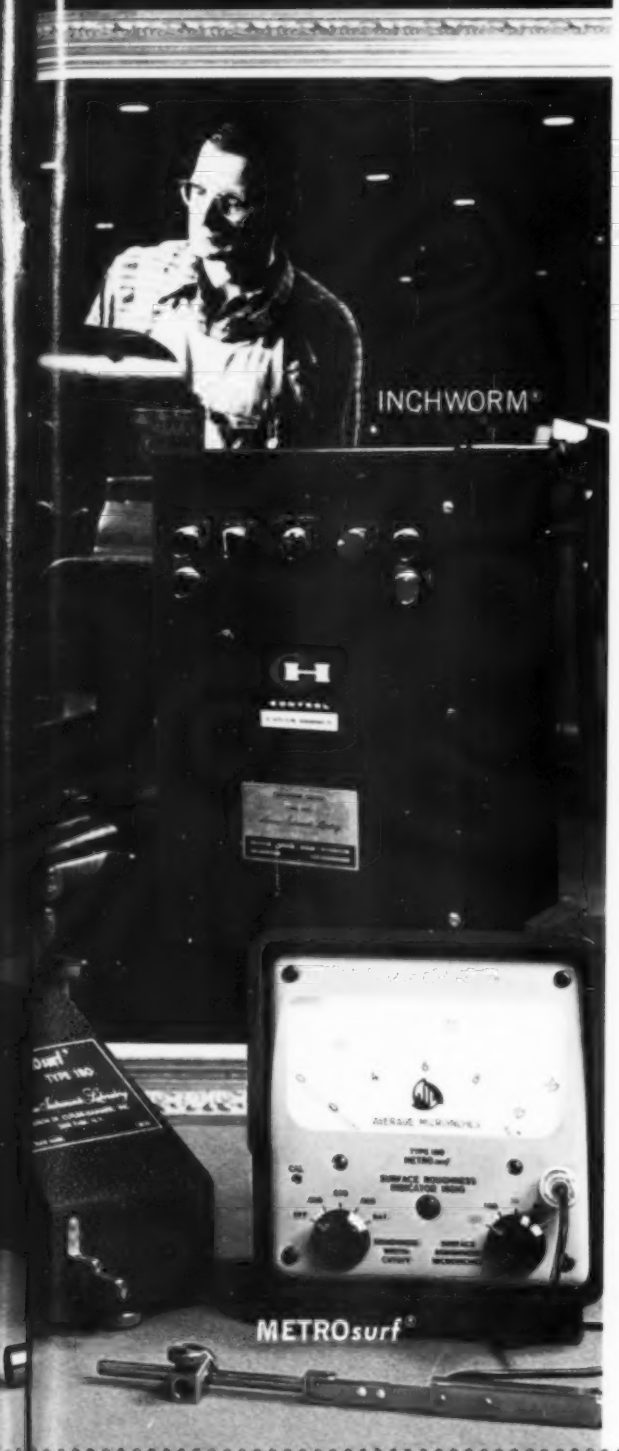

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Centerless grinders are freed from backlash, can maintain required tolerances in a way that will amaze you, when INCHWORM replaces the lead screw!

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Metalworking on the move

More copper in automobiles has been forecast in the wake of a Copper and Brass Research Association announcement of an all-out program to increase efficiency of internal combustion engines and to attack the smog problem through applications of copper. The use of copper with cast iron to develop a high-strength, thin-wall alloy for engine blocks that would weigh 30% less than standard blocks is one project. These alloys would have better machinability, with consequent longer tool life and lower production costs.

Magnesium uses in the United States have not kept pace with the growth of European applications, staying at about .66 lb. per capita, while England has moved up from .26 lb. to .55 lb. and Germany from .22 lb. to 1.19 lb., all per capita, during the last decade. It was not until 1955 that U. S. civilian consumption equaled military, though in the other countries cited industrial applications have become increasingly firmly established.

A combination of increased defense orders, a bulge in new orders, and a probable increase in prices could give metalworking companies a near-record profit year in 1962. The tally for 1961 will probably show record sales approximating $151 billion, but with profits below those of 1960, when sales were down by more than $2 billion. 1957's $1.1 billion in profit is still tops; it is well ahead of last year's $783 million.

All-aluminum engine blocks and pistons for automobiles are not yet a reality, but they are not far away, according to Ward's Automotive Reports. Main obstacles appear to be the development of an iron liner compatible with the pistons, or preferably, an aluminum cylinder alloy that would stand up in operation. High-silicon aluminum alloys have shown good wearing qualities, but are difficult to cast and finish. Eventual solution appears to be the elimination of a liner of any kind.

Steel service centers plan an annual capital outlay of about $55,000,000 for the next five years, according to an industry-wide survey—$67 million for metal cutting and similar equipment, $59 million for materials handling equipment, and the balance, roughly $150 million, for new warehouses or service centers. Instead of stock plates which have to be taken elsewhere to be cut to size, these "warehouses" now provide plate sized to the customer's specifications and ready for fabrication.

Small metalworking shops now have an opportunity to secure some of the advantages of bigness without losing current benefits by forming pools to bid for government work and other work within the limits of the pool, according to a policy approved by the Small Business Administration. Under the plan, each company contributes services to the pool for a proportionate cut of the profits, and still remains free to contract for business outside the pool, on its own. Requirements: companies must be "small businesses" by SBA standards, must know specifically what services and/or products they can contribute. Biggest handicap to date: weak central management.

Advances in American industry and technology will be on display for thousands of visitors at the World Metal Show, October 29—November 2, 1962, in New York's Coliseum. It will be the first American Society for Metals show in New York in 28 years. In going international in 1962, ASM points out New York's position in world trade and its status as headquarters city of the United Nations.

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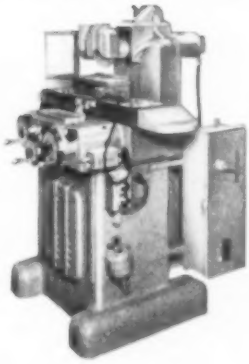

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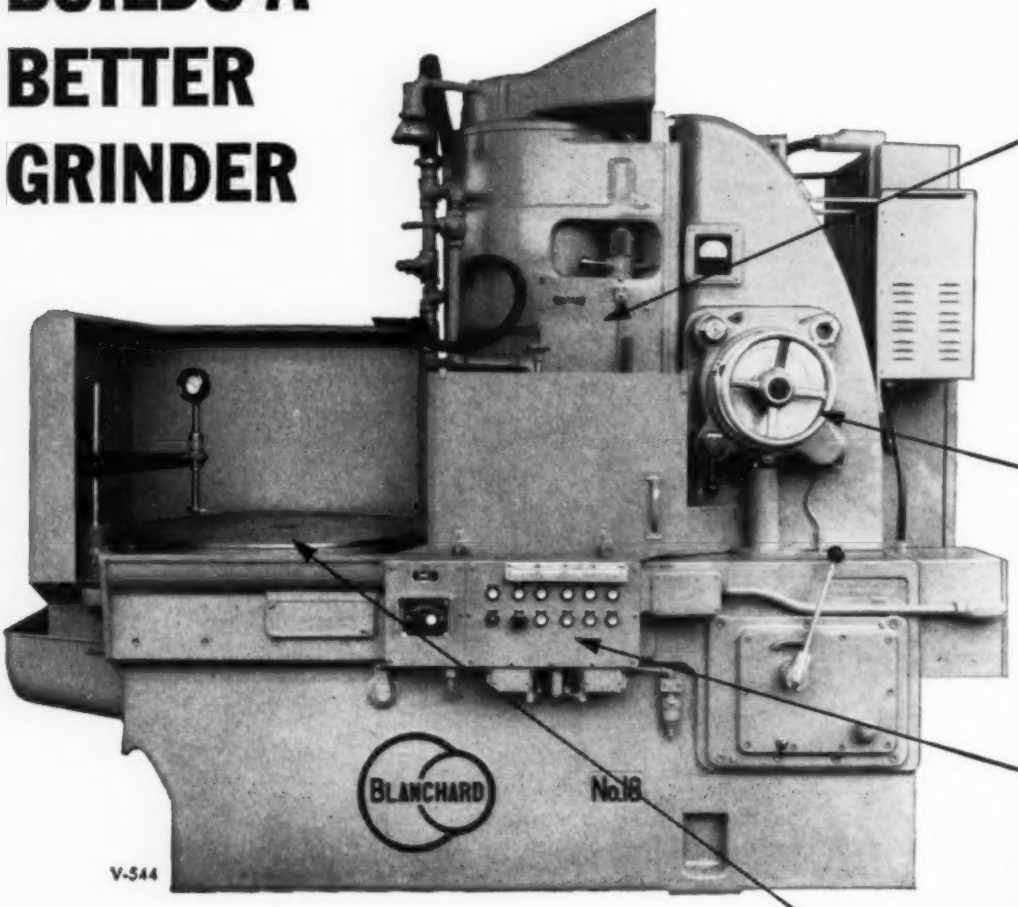

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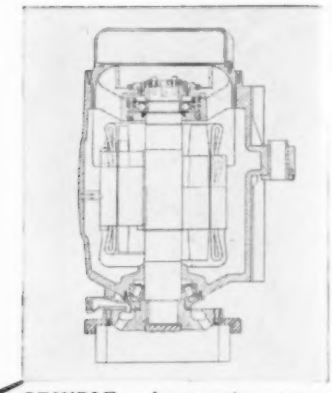
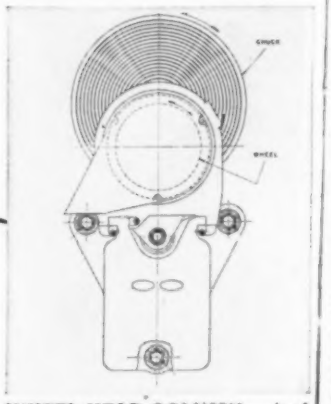
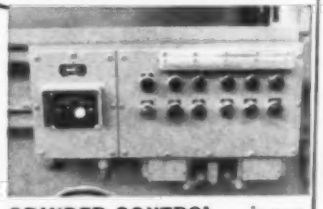


SPINDLE . . . incorporates a superior, pre-loaded anti-friction bearing system that removes all backlash and radial play. Integral "balanced" mounting of rotor on spindle eliminates vibration.



WHEEL HEAD COLUMN . . . is of heavy box-section design for extra rigidity . . . supported at 3 widely-spaced points. Column may be easily adjusted for alignment. Special column tilting devices available to produce concave or convex surfaces.



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GRINDER CONTROL . . . is compact and conveniently located for fatigue-free handling. All control panels are BLANCHARD manufactured for troublefree operation.

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Get complete details on all 24 models of BLANCHARD grinders. They're today's leading high precision, high production grinders on materials ranging from carbon to quartz . . . from bronze to steel. You can handle parts ranging from tiny jewels to giant plates up to 108″ across corners.

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Abrasive Engineer's Corner

ARTHUR RAKESTRAW • Contributing Editor

GRINDING SOFT STEEL WITH DIAMOND WHEELS

• What is your opinion concerning grinding soft steel with diamond wheels?—W. B. S., Akron, Ohio.

It would be interesting to know the circumstances that prompted this question. It is likely that it is related to the use of diamond wheels for backing off the soft steel shank of inserted tungsten carbide tool bits.

Diamond grinding of soft steel is extremely costly. Because of the increased penetration of the soft material, diamond particles are easily dislodged. Wheel wear is excessive, and wheel costs might run as much as seven to ten times that of a manufactured abrasive wheel.

It is certainly not advisable to use diamond wheels on operations that can be performed much more economically by aluminum oxide or silicon carbide wheels.

COOLANTS OR CUTTING OILS

• The cutting lubricant has always been a problem for us, and we would be interested to receive your suggestions. To date, we have had little success with high detergent solubles. The best one we have found requires the operator to wear protective clothing and gloves.—E. A. W., Montreal, P. Q.

There are so many good high detergents on the market that I wonder whether your problem might not lie elsewhere than in the coolant itself.

It is possible, for instance, that your difficulty stems from the use of hard water, which does not permit the compound to go into solution. If that is the case, the introduction of a small amount of sal soda may improve the solubility of the water.

You should be able to get satisfactory performance without using a product which requires operators to use protective clothing.

"Sure. Diamond swarf's worth about five bucks a pound!"

GENERATING CENTERS AFTER HEAT TREATING

• Will you kindly tell me what is the best method of generating centers after they are heat treated and have collapsed to become egg-shaped?—J. M., Westfield, New Jersey.

Reading your question brought to mind many instances in the manufacture of aeroplane parts during World War II, when extreme accuracy of centers was of primary importance.

At that time the centers of large parts were ground on internal grinding machines, the part being held on a face plate fixed to the work head spindle. Small centers in shafts were corrected by regrinding on center laps. Some manufacturers applied loose abrasive to the lapping stones to improve the finish.

Recently there was advertised in GRINDING and FINISHING a center grinding machine which may well be an answer to your problem. I have examined their literature, and their approach seems to be sound. While editorial policy frowns upon mention of specific company names in these columns, the company is located in your city. Theirs is the only special equipment of this kind that has come to my attention recently.

CENTRAL COOLANT SYSTEM?

•During recent years I have heard much about central coolant systems as applied to grinding departments. The idea has interested me, yet I have been unable to get sufficient information to plan for the future expansion of our grinding department. Can you supply me information of this sort, or provide leads through which I may draw this information?—J. K., Argonne, Illinois.

This subject was rather thoroughly covered in a 1959 article in GRINDING and FINISHING ("Central Coolant Systems . . . Cure or Curse," April, 1959).

The heart of this article was:

"Basically, a central coolant system will be advantageous:

"If the same coolant is common or can be used on 90% of the machining operations.

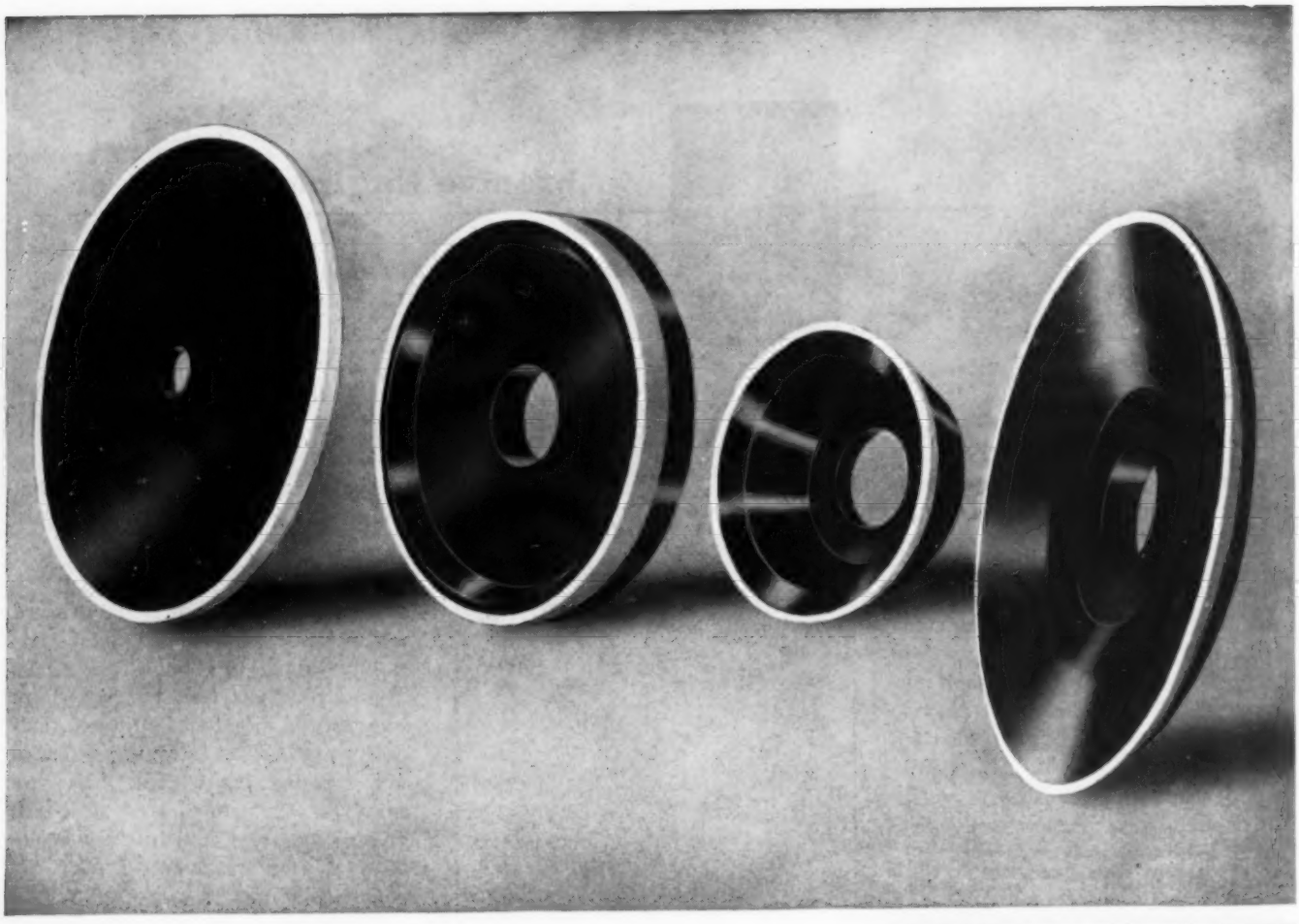
"If a certain degree of coolant cleanliness can satisfy the requirements of all the machines.

"If future planning will not require movement of groups of machines to other locations outside the area of the system.

"If quality coolant equipment is installed to service the system."

(A limited number of reprints of this article are still available. If you'd like one, just drop a note to Reader Service.)

THE CORNER is a good place to share your problems, comments, and experience in abrasives and their uses. Send your questions or contributions to: A. S. Rakestraw, GRINDING and FINISHING, Wheaton, Ill.



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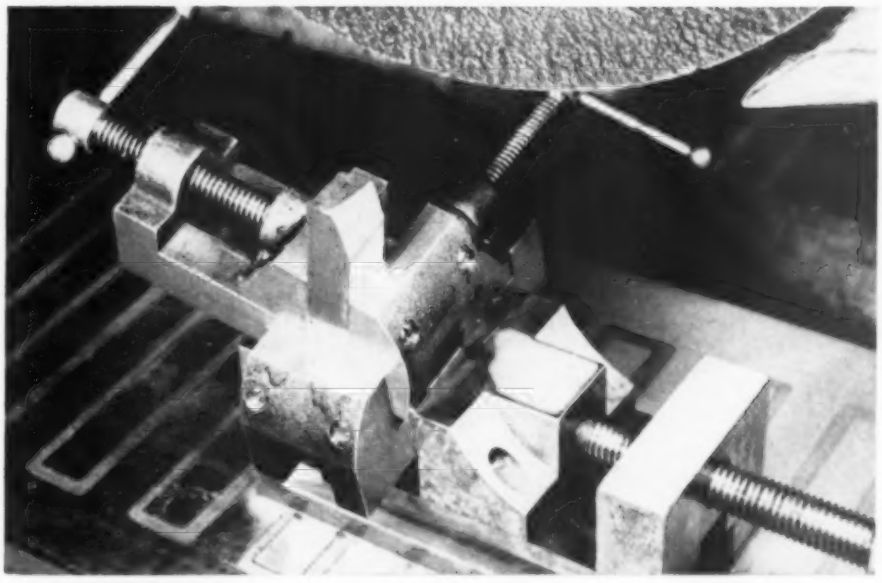
COMBINE VISES FOR COMPOUND ANGLE WORK

By H. J. GERBER

• If you don't have a compound angle vise in an emergency you can still improvise a satisfactory set-up by the use of three small precision toolmakers' vises.

The vises are held one in the other, as illustrated, at predetermined angles and seated on the magnetic chuck of a surface grinder.

Angular settings can be made by use of a bevel protractor or sine bar, depending upon the degree of accuracy required.



Three vises can substitute for one compound angle vise.

"TWO-WAY GRIND CUTS TIME, STOPS CHIPPING

By JEWEL W. INGRAM

• Chipping and excessive time were our problems in surface grinding .200" from the length of Alnico magnets, plain cylinders .625" long and .500" in diameter. At the start, we were using a friable white aluminum oxide wheel, 60 grit, J grade, 5 structure, vitrified bond, and removing .005" per pass. Grinding a magnet took an hour, mainly in trying to avoid the chipping that occurred as the trailing edge of the wheel left the workpieces.

We tried cutting them on a lathe, but this resulted in excessive tool wear and cracking of the magnet, in addition to the chipping.

Back on the surface grinder, a softer, more open wheel (H grade, 8 structure) in a different vitrified bond eliminated some of the chipping, but still required considerable time and care.

The problem wasn't solved until I tried feeding half-way across the end of the magnet, then crossing the table and feeding from the other side to finish the cut at the cented of the magnet.

By this means I could feed down .100" at a pass, and finish a magnet in five minutes rather than an hour with no chipping whatever.

OPERATION OF MOUNTED WHEELS AND POINTS

• For best results the following rules should be observed when using mounted wheels and points.

- Thoroughly check the condition of the grinder. To insure safe operation, worn bearings and spindles should always be replaced.
- Carefully examine the wheel to see that it has not been damaged, is securely mounted on the mandrel, and the mandrel is not bent.
- Check to see that the machine does not exceed the maximum safe operating speed of the wheel or point being used.
- Insert the mandrel so the wheel is as close to the chuck as possible. When extra length mandrels are being used, extreme caution should be observed.
- Use light pressure between wheel and work. Excessive pressure may bend or break the mandrel, particularly with small points where the end of the mandrel that enters the wheel is of reduced size.
- ALWAYS WEAR SAFETY GLASSES OR GOGGLES.

(Courtesy Simonds Worden White Company)

CATCH SEDIMENT BEFORE IT REACHES COOLANT TANK

By JEWEL W. INGRAM

• As with most plants, I am plagued with the time involved in cleaning coolant tanks. This is my solution.

One of our grinding machines is a No. 5 Brown and Sharpe cylindrical grinder equipped with a filtration unit. To clean the tank and change the filter takes approximately 1½ hours, twice a month, at a cost of about $30.00 per month.

Recently I installed an ordinary bread pan just under the wheel and and work to catch sediment. I punched small holes in the sides to let the coolant drain through.

The pan catches about 90% of the sediment, and at the end of each shift I just dump the sediment into the nearest waste can.

Using this method, I have to change coolant only every four to six months. This will mean an additional savings of about $125.00 every six months. Further, the coolant is cleaner, producing better finishes.

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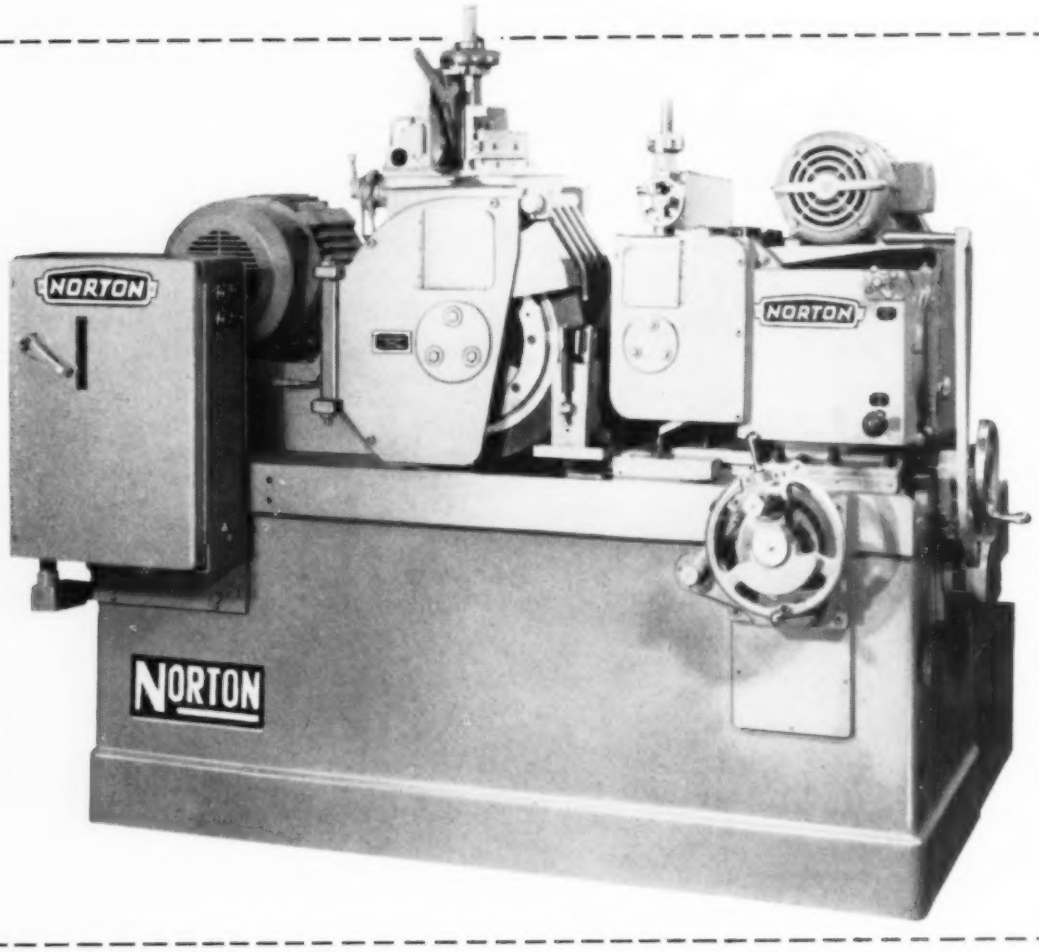
The Norton No. 2 Straddle-Bearing Centerless Grinder is built for productivity...



The new Norton No. 2 Centerless Grinder can be arranged for full automatic, semi-automatic or manual thru-feed or plunge grinding. Capacity includes work diameters ranging from 1/16" to 4 3/4" depending on type of work rest and bar grinding fixture.

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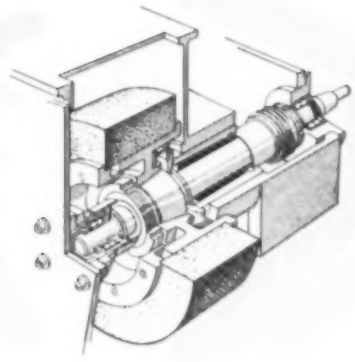
3 MAJOR ADVANCEMENTS IN CENTERLESS GRINDING



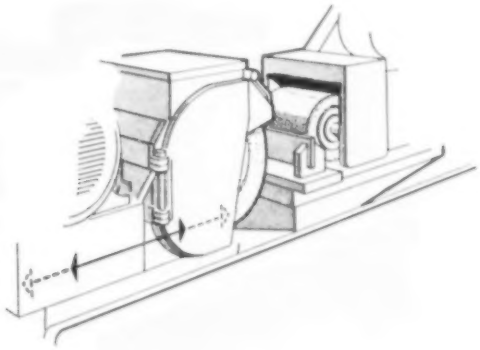
accuracy . . . economy

Straddle-Bearing Spindle Support, in both grinding and regulating wheels, provides extra strength. Combined with the inherent rigidity of Norton spindles this boosts capacity to take heaviest cutting pressures, while permitting fast grinding to close tolerances under all conditions.

Like all Norton grinders and lappers the Norton No. 2 *Straddle-Bearing* Centerless Grinder is built to deliver "Touch of Gold" performance — the Norton extra that adds value to your product while cutting your production costs.

You'll find plenty of proof of that in the modern construction of this newest machine of its type. *Straddle* support of spindle bearings adds strength and ability to take tough jobs . . . the mobile wheel head and constant work-loading alignment make jobs shorter and easier.

Many other features result in outstanding performance advantages. Call your Norton Sales Engineer, a trained expert in the grinding field, for consultation on how these features can benefit your production. Or write for Catalog 1328. NORTON COMPANY, Machine Division, Worcester 6, Mass.



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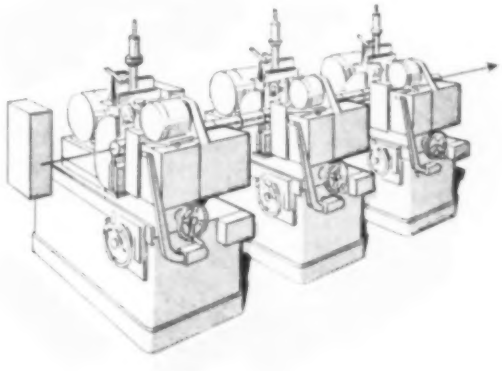

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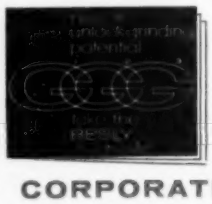

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Design for Grinding

RICHARD L. McKEE • Managing Editor

Abrasive machining for rapid stock removal

The objectives of the Norton Company research project in abrasive machining run parallel with the objectives of this column. Hence it is appropriate to present what is in essence a progress report of the first year of the project in excerpts from a speech by one of the engineers involved.

● "At least 30% of the machining operations in American industry today are being done by obsolete methods," said Richard H. Merritt, research engineer for Norton Company.

Merritt made this statement recently at the 11th annual Tool Engineering Conference sponsored by the Illinois Council of Chapters of the American Society of Tool and Manufacturing Engineeers on the campus of Augustana College, Rock Island, Illinois.

Abrasive Machining Saves Scrap Costs

"Abrasive machining is a way for manufacturers to save a large part of the $14 billion now spent each year just to remove unwanted metal," said Merritt. "These 18 million tons of scrap metal, costing $14 billion to remove, would fill a continuous line of trailer trucks, bumper to bumper, from Boston to Los Angeles."

He outlined the several ways abrasive machining can reduce the cost of producing metal parts. Smaller amounts of excess metal are required on castings and forgings for proper machining. Work can be set up on abrasive working machine tools quickly and without expensive work holding fixtures. Proper cost accounting studies of abrasive machining versus conventional cutting tool machining will most often show the former to be more economical.

Open Minds Needed

"The real challenge to the metalworking industry is the need for open minds willing to consider new techniques," continued Merritt. "Grinding has laways been considered appropriate for heavy stock removal on billets and rough castings where dimensions are not a consideration. Grinding has also been considered the best way to achieve a fine finish and accuracies measured in millionths of an inch. A logical question then is, 'Why not use abrasives for metal removal in the intermediate area where moderate to heavy stock removal is required?' In this area, traditionally reserved for cutting tool machinery, we found that abrasive machining properly applied has its place alongside millers, planers and other cutting tool machines.

Twofold Purpose

"Our present project has a twofold purpose. First, we are investigating the areas where abrasive machining is economical with grinidng equipment already found in most metalworking plants and, second, we are investigating the requirements for new abrasive products and machine tools needed to get the maximum benefits from abrasive machining."

Merritt pointed out that recent improvements in grinding wheels and the machine tools on which they are used are making these savings possible. Some machine tools are now being made specifically for abrasive machining.

"Those machine builders who have recognized the potential benefits from this new field of machining are currently enjoying a level of business far better than the rest of the machine tool industry," he said.

Savings Possible on Present Machines

"Although the new machine tools specifically designed for abrasive machining are going to be a big factor in the future, American industry can begin realizing the benefits of abrasive machining right now on existing equipment," said Merritt.

Horsepower Need Modified

Recent tests in the Norton research laboratory have disproved an opinion long shared by machinists that it takes 10 horsepower to remove one cubic inch of metal per minute with abrasives. Using the best suited machines for abrasive machining, this figure has been determined to be between three and four horsepower on high strength castings. Even on a surface grinding machine originally designed for light duty, seven horsepower was all that was required for machining steel after determining the optimum abrasive wheel specification and grinding fluid. A figure of one horsepower per cubic inch of metal removed per minute is a figure widely quoted for cutter tool machines. The research project has found that this power requirement is often considerably higher, however.

Merritt concluded by saying, "Domestic and foreign industrial competition indicate increased productivity to be not merely desirable, but absolutely essential for survival."

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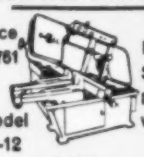

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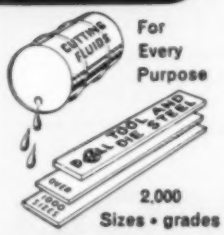

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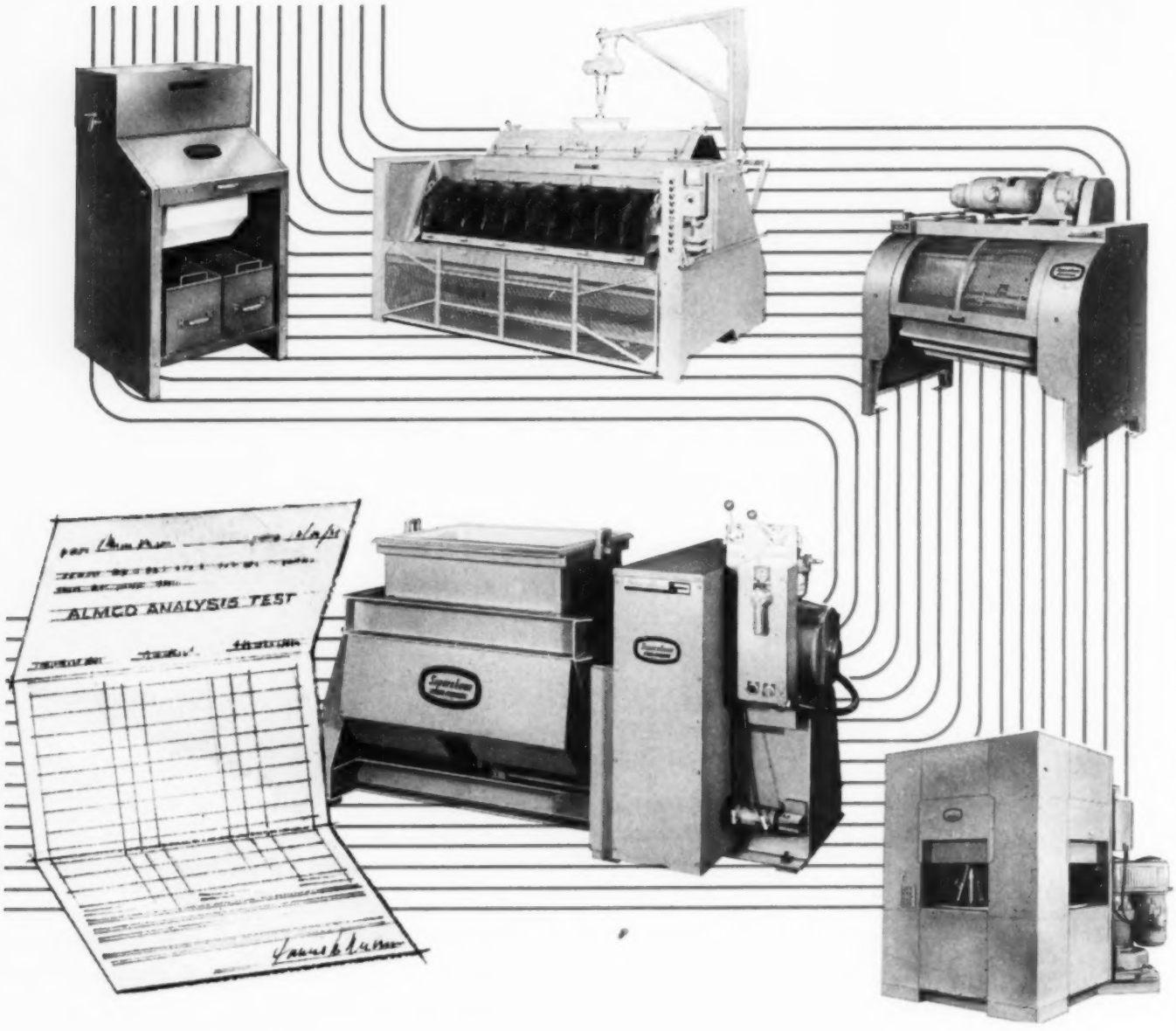

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Where Are We?

For the past three years we have presented in the January issue an article concerning the state of the industry. The purpose has been to provide you with opinions from the leaders of our industry. The expressions are formed from positions which enable these men to see beyond your range of vision and to correlate past developments.

The unique position from which these men judge the past and predict the future does not assure accuracy, however in contacting over 100 individuals we are able to select those statements which seem to express the most beneficial opinions. A pattern has always developed which has pointed directly to the most important subjects.

In the past, we have set the boundaries of these statements to the calendar year. This restriction has limited the statements. The answers to our queries on the past and future have been in some instances strained in order to stay within the boundaries. This year we relieved the situation by removing this restriction. Those contacted have been asked simply to provide a statement which they believe will fulfill the purpose of the article.

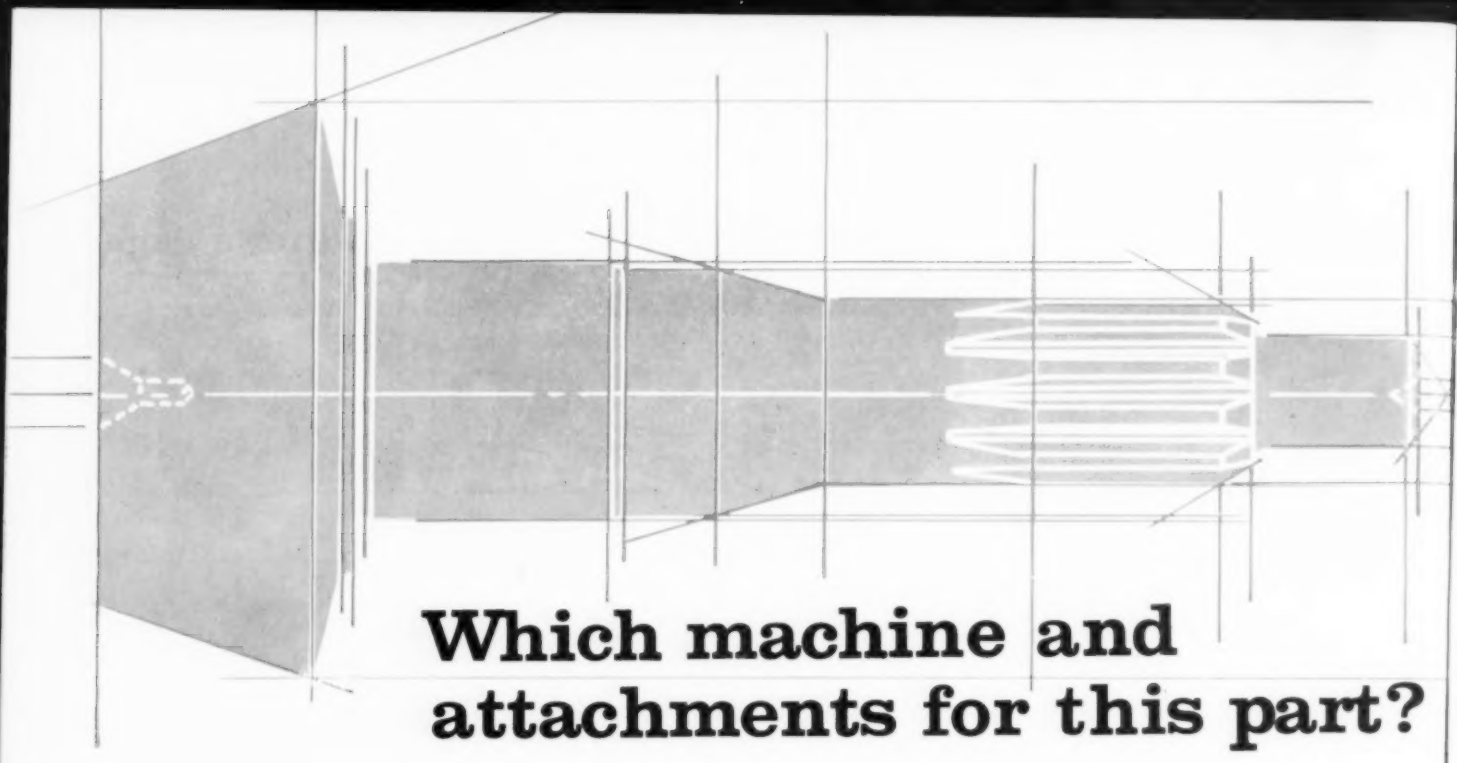
It might seem academic to present summaries of the past and a look at the future as new developments have been covered well, but the trends which developed or will develop can be very advantageous to the alert. Major developments which challenge well established areas may not be used to their full potential for several years due to the other areas being overlooked in the notoriety about the development. These trends or new areas which open up are the subjects which the leaders of our industry can bring to you.

While most of us are concerned with a particular part being machined by one process and another part by still another process, these men are concerned with every part, material or requirement machined by one, two or maybe more processes. They must not only be well versed in their own areas but in the competing areas as well.

Thus the State of the Industry article which will appear in the January issue will enable you to pick the brains of the experts. It has been well received in the past and should be extremely beneficial to all who read and cogitate.

M. M. Patterson

Editor, Grinding and Finishing



Which machine and attachments for this part?

By F. KENWOOD JONES, Chief Sales Engineer,
Machine Tool Division, Norton Company

Every attachment or specific machine is offered by the original equipment manufacturer or attachment manufacturer for a specific purpose. These attachments can be extremely beneficial to an operation, or they can be an unnecessary expense. Evaluation of each attachment with respect to four operational requirements will assure proper selection.

• There are four requirements which must be considered when purchasing specific machines and attachments.

Production
Accuracy and reproducibility
Control of production rate
Amount of operator attention or control

Some of these factors will weigh more heavily than others depending on the circumstances, but all will affect the problem. These factors are considered when equipment is recommended and must be considered also by the engineer accepting the recommendation. While the equipment manufacturer's engineer will recommend a number of choices based on a variation of emphasis placed on the four factors, the process engineer must select that recommendation which will most accurately answer his company's needs. Much of this selection has been made by the choices recommended, but the process engineer being closer to the problem must make the final selection based on the more intimate knowledge of the relative weight placed on the four factors.

What Type of Machine?

The first decision to make is the type of grinding machine and the size (swing and work length). A plain cylindrical grinder will handle the job. So will an angular wheel slide grinder or a special purpose plunge grinder. Even a universal grinder can be used.

Since the job is long-run, single part operation, the universal grinder is ruled out. The versatility of a universal is ideal for toolroom use or the job shop but it is not usually economical for long production runs.

Whatever machine is selected, how will it be tooled to do the job? Will it be arranged for semi or fully automatic operations? Will it be incorporated into an automatic work handling system? Will it be equipped with automatic gaging devices?

The engineer who develops a recommendation for the most economical equipment to handle this grinding operation must consider a wide range of optional or necessary features.

The accompanying chart shows which of the following elements of a precision grinding machine he would consider for increasing production, improving accuracy or reproducibility, controlling the rate of production, or operator attention required.

Type of Machine

One choice for the typical job illustrated on these pages would be a plain cylindrical grinder. Each diameter could be ground separately, and with a shoulder grinding attachment the shoulder could be ground to required finish and dimension. A basic machine could be provided for completely manual operation although for this type of job some automatic features would be added. A cylindrical grinder would be a logical choice if

the machine were to be retooled in a few months or a year to handle another part basically suited to a cylindrical grinder.

An angular wheel slide grinder would be recommended if enough work requiring shoulder grinding could be anticipated during the useful life of the machine. For such parts, the shoulder grinding abilities of the angular grinder make it a better choice than a cylindrical grinder.

A special purpose plunge grinder offers certain advantages. If the part is to be handled between grinders with automatic handling equipment, the plunge grinder lends itself better to automatic loading turrets. There are fewer parts to wear or require adjustment. Retooling for another part, on the other hand, may be a more extensive operation because the machine components are specifically positioned to the base to fit the particular workpiece being ground.

Semiautomatic Operation

On any repetitive grinding operation where the run is reasonably long, semiautomatic plunge grinding is a distinct advantage. After the initial setup, the operator need only push a lever to initiate the grinding cycle. The cycle is controlled by a timer which regulates the infeed rate for rough and finish grinding and the final finishing grind. The operator must periodically check size, adjusting the infeed to compensate for wheel wear unless automatic wheel wear compensation is added.

Automatic Truing

Because manual truing of the grinding wheel is time consuming and often requires disturbing the setup, automatic truing is a desirable optional feature to increase production. Automatic truing can be set to true the wheel after each grind or after any preset number of grinds. The setup is not disturbed and the time required for truing is only a few seconds. The amount trued off the wheel in automatic truing is generally far less than would be removed manually by the operator, resulting in less wheel loss due to truing.

Automatic Wheel Wear Compensation

To compensate for the amount of abrasive removed from the diameter of the wheel by automatic truing, a mechanism can be built into the grinder to automatically advance the wheel slide a small increment to compensate for the amount removed. This eliminates the need for the operator to make corrections on the infeed control handle saving time and eliminating the possibility of error.

Automatic Endwise Work Locator

Parts to be finished by plunge grinding must frequently be accurately located longitudinally before the wheel. Variation in center hole depth, or in flange thickness, for example, can cause a misalignment of the work unless correction is made. The workpiece we are considering here is such a part. Endwise work locators can be installed on precision grinders to move the work table the precise amount to always present the work to the wheel in the proper relationship. Electrical probes are generally employed against a base surface to actuate the hydraulic table traverse system.

Wheel Contact Accelerator

In most production runs, there will be some variation of diameter in workpieces presented to the grinding wheel. To prevent damage to the work or the machine, it is customary to set up an automatically cycled machine to begin its grinding feed just before the wheel reaches the outside diameter of the workpiece with the diameter at the maximum end of the tolerance range. For any smaller diameter pieces within the tolerance range, the grinding wheel will "cut air" until it reaches metal. Over a period of time, these lost seconds will represent a substantial amount of lost production. The wheel contact acceler-

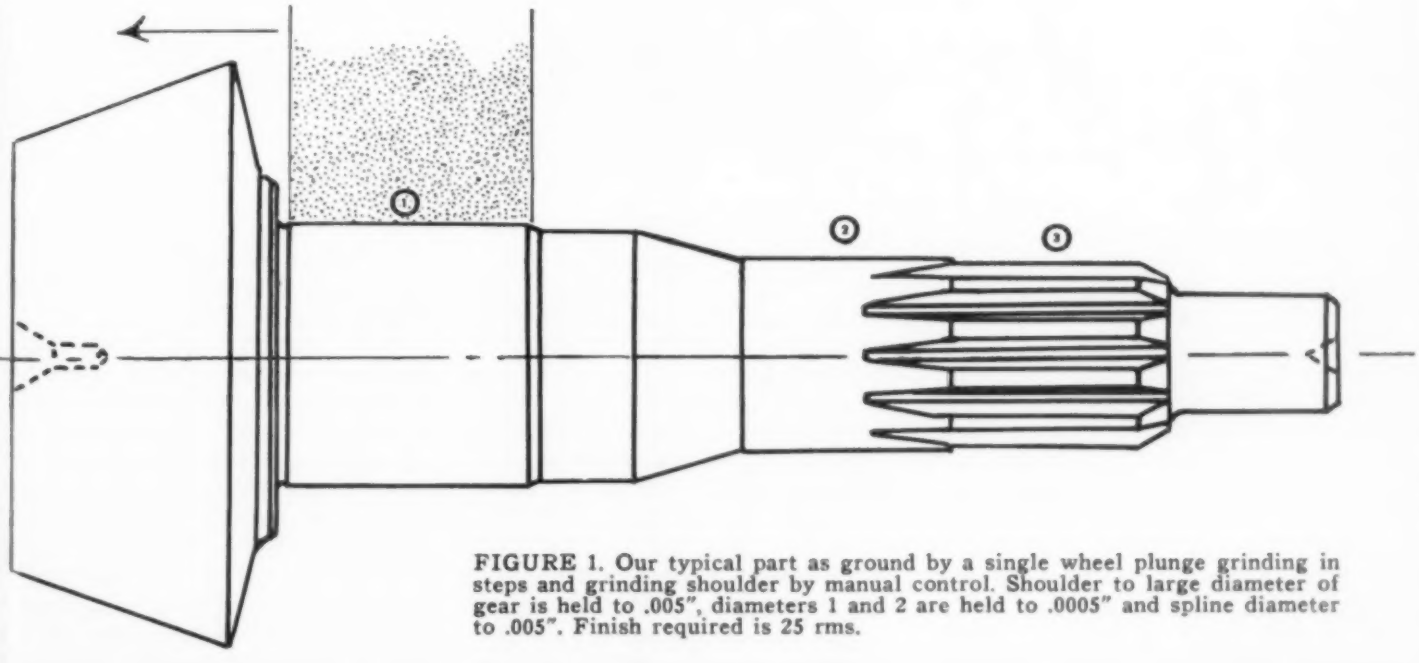


FIGURE 1. Our typical part as ground by a single wheel plunge grinding in steps and grinding shoulder by manual control. Shoulder to large diameter of gear is held to .005", diameters 1 and 2 are held to .0005" and spline diameter to .005". Finish required is 25 rms.

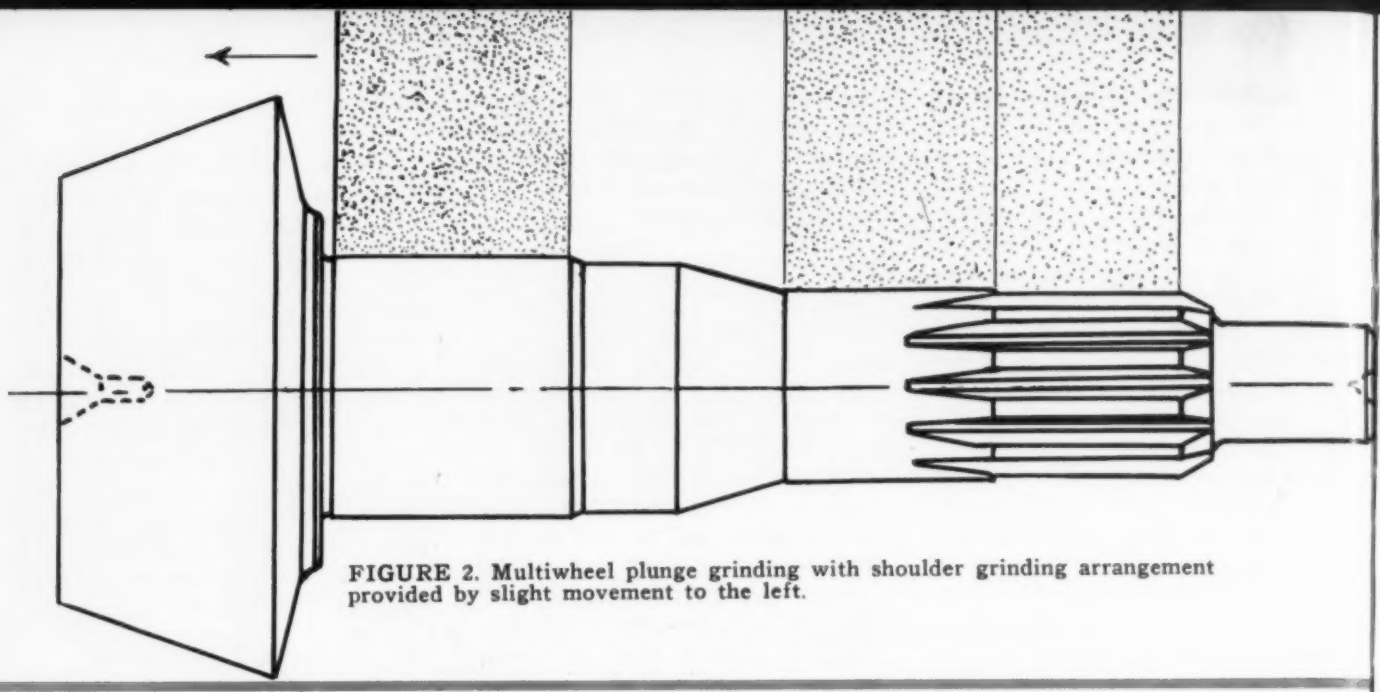


FIGURE 2. Multiwheel plunge grinding with shoulder grinding arrangement provided by slight movement to the left.

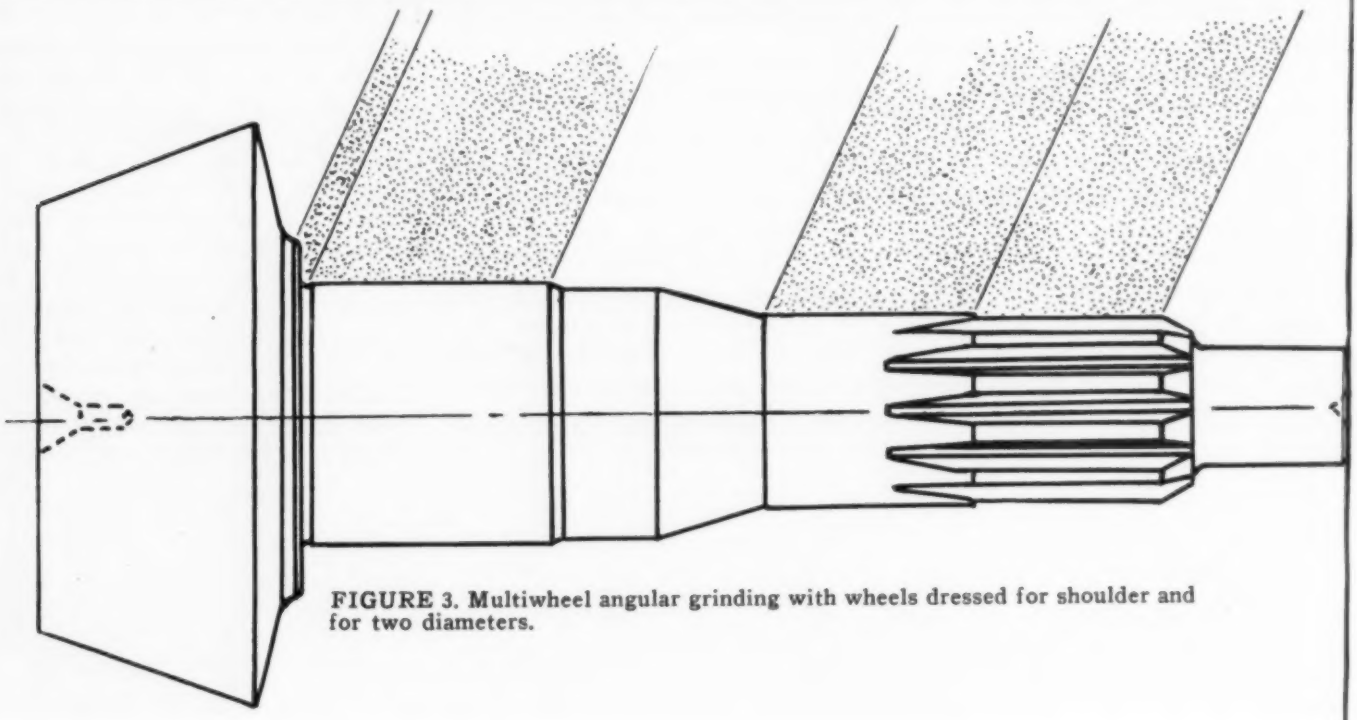


FIGURE 3. Multiwheel angular grinding with wheels dressed for shoulder and for two diameters.

ator permits the wheel to advance to the work, slowing to the grinding rate just as it reaches the work, eliminating lost time "grinding air."

Higher Wheel Speed and Automatic Balancing

The development of grinding wheels and grinding machines approved for operation at 8,500 surface feet per minute offers an excellent opportunity to decrease the grinding portion of the cycle by as much as 30%. Experience has also shown that less truing is required and wheel wear decreases when grinding at speeds higher than 6,500 s.f.p.m., representing further economies. The application of higher speed requires wheels and machines especially made for this speed. Automatic balancing of the wheel sleeve on its spindle while rotating at grinding speed is desirable under these conditions.

Combine Cuts

Plunge grinding of two or more diameters on a workpiece may be accomplished simultaneously by the use of a wide wheel or multiple wheels. In grinding a shoulder, as in our example, both the diameter and shoulder can be ground simultaneously with an angular machine or with a cylindrical grinder equipped with a shoulder grinding attachment. Multiple cuts in a single plunge cut obviously represents a substantial time saving compared to the practice of grinding each surface individually.

Constant Peripheral Wheel Speed

As a grinding wheel wears, the peripheral wheel speed falls off. This change in speed will cause the wheel to act softer, and there will be a noticeable variation in the grinding action unless some compensation is made. Changing sheaves will correct it in steps but in high production grinding, the use of a constant peripheral wheel speed device will insure uniform speed conditions throughout the life of the wheel. This serves to eliminate one of the sources of inaccuracy in finished work.

Hydraulic Footstock

Operator fatigue is a factor to consider in high production runs. The use of a hydraulically operated footstock serves to reduce operator effort in the loading and unloading operation. Seconds saved on each cycle add up to considerable time during the life of the machine and these savings will often justify adding this feature.

Automatic Loading and Unloading

The ultimate in automatic grinding is achieved when the grinding machine can be loaded and unloaded without human attention. Such equipment, particularly in connection with heavy or awkward parts, permits the establishment of predetermined production rates throughout the working day since no fatigue factor is involved. Such equipment also permits one operator to supervise the operation of two or more machines, thereby raising the productivity per man hour. Automatic loading and unloading is generally faster on irregular shaped parts than manual loading and unloading, thereby resulting in a shorter over-all grinding cycle.

The following features are considered when improvement in grinding accuracy is desired:

Visual Grinding Gage

A snap-on type gage which measures the work diameter as it is being ground will help the operator control the cycle to produce more accurate work.

Automatic Gaging

By integrating the measuring gage with the machine control system, the gage can be used to control the grinding cycle. Either air or electrically operated gages can be used to control the infeed rate, grinding rate and sparking out periods of the cycle. The gage will automatically retract the wheel slide when finished size is reached.

Ultra-Fine Sizing Wheel Feed

Where ultra-precision is a requirement, the wheel feed mechanism can be designed for ultra-fine feeding of the grinding wheel to the work. Such arrangement might slow the cycle too much for conventional tolerance grinding but where a high degree of precision is of primary importance, this feature is often worthwhile.

Refined Limit Manufacture

Another available option to consider, in a machine to be used on parts where ultra-high precision is required, is the specification of refined limit manufacture. In this case, the machine manufacturer will build the machine to closer tolerances in the essential mechanisms than those required for conventional precision grinding.

Tapers

When tapers are to be ground, the precision of the taper depends upon the setting of the swivel table. This setting can be checked within precise limits by means of special gaging. Various electrical or electronic devices are available to indicate taper.

Control of Coolant and Hydraulic Oil Temperature

In extremely precise grinding operations, it is sometimes desirable to control the temperature of coolant and hydraulic oils used in the grinding machine to maintain completely uniform conditions. Cooling units can be installed in coolant and oil reservoirs, controlled by thermostats, to maintain the fluid at a fixed temperature.

Coolant Filters

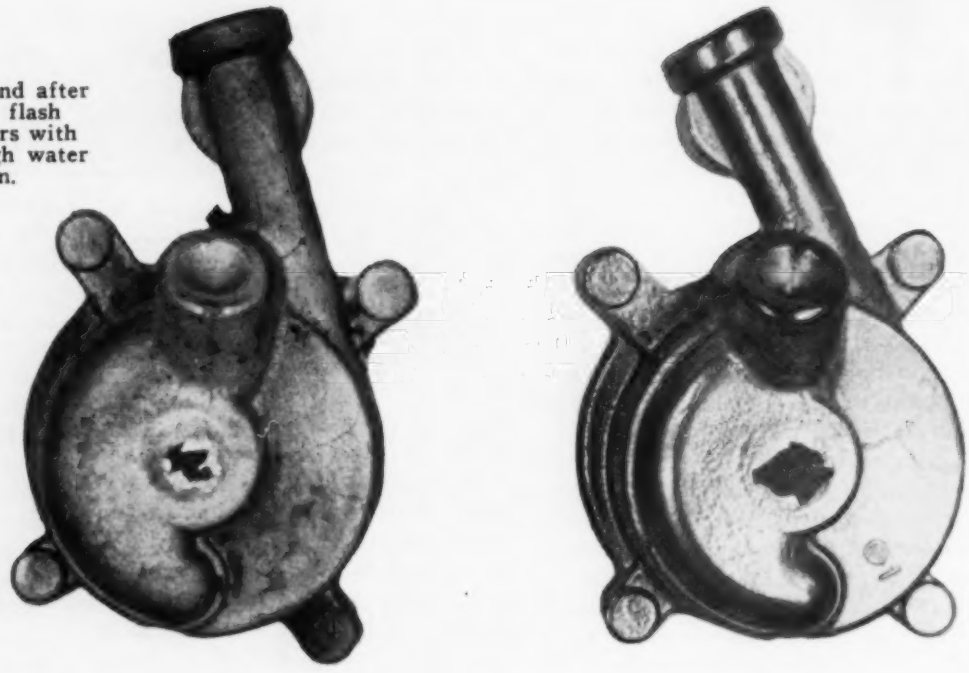
In normal grinding, the swarf, consisting mostly of minute grinding chips, settles to the bottom of the coolant tank and is removed periodically. It is sometimes desirable to filter the coolant before it reaches the tank as a precaution to prevent any particles of swarf from being carried over to the work as the coolant is recirculated. This precaution is generally required only where an exceptionally good finish is called for.

Where several cuts are made simultaneously by using multiple wheels, the increased volume of swarf thus produced may be so great that it will not settle in the tank sufficiently fast to prevent recirculation. Filters designed to handle large volumes of swarf are available to fit any type of grinding machine.

The profitable use of these optional time-saving features depends on such factors as the size and shape of the workpiece, the production requirements, the dimensional limits and finish called for, and degree of automation desired. There is rarely a standard machine that can be selected from a catalog to meet the needs for this type of production machine tool. Each machine, though it is assembled from standard components, must be constructed to perform a specific job for the user.

Precision grinders, perhaps more than any other production machine tool, require this individualized approach in their initial selection and manufacture.

	Higher Production	Greater Accuracy or Quality	More Consistent Production Rate	Less Operator Effort
Semi-automatic plunge operation	x		x	x
Automatic wheel truing	x		x	x
Automatic wheel wear compensation	x	x	x	x
Automatic endwise location	x	x		x
Wheel contact accelerator	x			
Higher wheel speed with automatic balancing	x	x		
Combine cuts	x			
Automatic wheel truing while grinding	x		x	
Constant peripheral wheel speed	x	x	x	
Automatic gaging	x	x	x	x
Automatic work loading and unloading	x		x	x
Ultra fine sizing wheel feed		x		
Refined limit manufacture		x		
Taper correcting indicator		x		
Control of coolant temperature		x		
Control of hydraulic oil temperature		x		
Filters for coolant		x	x	



Brass carburetor parts before and after processing. Operation: remove flash and improve color. Time—2 hours with aluminum oxide, medium to high water level, and barrel rotation 4 rpm.

Rotation + Vibration=vibratory barrel finishing

Combining vibration with the rotation of barrel finishing provides a novel, rapid, and efficient method of finishing. Both can be used together, or either may be used separately, to provide extreme flexibility.

By B. W. ELLIOTT, President Vibraslide, Inc.

● In the field of barrel finishing, the application of vibration to the barrel has aided an effective new means of generating accelerated, highly productive action.

The objectives of vibratory barrel finishing—like the objectives of the original barrel tumbling process—may be defined as cleaning, descaling, deburring, grinding, coloring, burnishing, polishing, or generating radii or micro finish.

The vibratory process, like the original barrel process, involves a container loaded with media and work pieces, to which chemical compounds and water are added as accelerators or controllers.

The mechanics of both processes require the generation of motion to cause a rubbing or impact, or a combination of both, between the media and the work pieces.

The revolutionary step of adding vibratory motion to the barrel overcomes a basic limitation of barrel finishing—its complete dependence on the force of gravity to cause a work-producing, downhill slide.

Limits of Conventional Barrels

Authorities agree that in all the many types of conventional barrels, nearly all work is done during the motion of media and work pieces in the slide of the inclined load surface. At the bottom of the gravity slide, media and work pieces are brought to rest. Little or no effective work is accomplished as they are carried under the sliding load and upward to the turnover point.

The limitation of this process is that where there is motion at the surface of the mass there is little pressure,

Loading a Vibraslide barrel at Food Machinery & Chemical Corp., Hoopeston, Ill., and using vibration of barrel to shake media out of pan.

and that where the weight of the mass produces pressure, there is little motion.

Vibration Provides Continuous Motion

There is no motionless, "at rest," unproductive mass in vibratory barrel finishing equipment. Vibration generates active rubbing movement of media around work pieces throughout the load. Since active motion occurs where pressure is created by the weight of the mass, the effect of the process is tremendously increased.

Further, the introduction of precision control of directional motion in the vibratory process enormously increases its potential uses. Machine parts heretofore too intricate for conventional barrel finishing, containing holes and recesses which the rotary tumbling process by itself could not penetrate, now lend themselves to speedier, cost-saving vibratory processing.

The practical objective is to achieve an end product as perfect as possible in point of micro-measurement and polish. The more nearly perfect the work product is when the vibratory finishing is finished, the lower the dependence on costly hand operations.

Mechanics of Vibratory Finishing

Realistic translation of the multi-motion theory of vibratory action into a practical production fact has been accomplished in the rotary-vibratory tumbler barrel device through multiple controls which do not exist in the relatively simple conventional rotary finisher.

The vibratory-rotary finisher is activated by two motors, one controlling the rotary action, the other controlling the vibratory action. Since both motors are adjustable to speeds through a six to one range, it is apparent that the vibratory finisher provides far greater precision control than the conventional model.

Further control exists, of course, in the abrasive media, which in itself is being constantly improved from day to day. Further controls exist in water levels and media formulae.

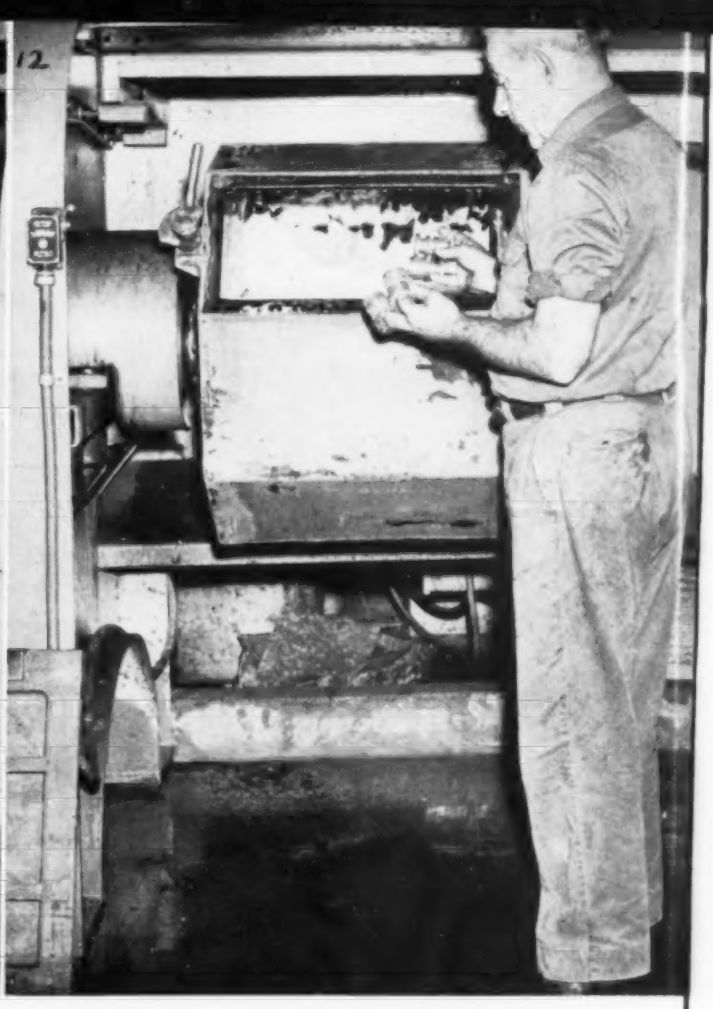
The lateral and penetrating motion provided by vibration is produced through an ingenious arrangement of cams and eccentric flywheels. The motors, housed separately from the vibrating unit, are independently operable to provide rotary or vibratory motion or both. Amplitude and frequency are controlled within a range that produces maximum scrubbing action with energy-amplitude below the level to produce impingement, providing normal media techniques are employed.

New Applications

The combination of accelerated vibratory motion throughout the load, with the protective factors of higher loads and reduced speed, extends the economy and uniformity of mechani-

continued

Unloading Vibraslide, Smith Corona Marchant, Syracuse.



Inspecting parts, Bendix Corp., Utica, N.Y.

cal finishing to many new applications.

Outstanding are those requiring action in recessed or shielded areas, and those with edges, surfaces, or protrusions too critical to be processed in conventional tumblers.

The following examples are illustrative:

Deburring heavy (21-oz.) steel pinion. A vibratory finisher replaced three hand operations to deburr, radius and surface finish without nicking or upsetting.

Deflashing die-casting. Rejector pin flash in recessed areas could not be removed in conventional tumbling. A vibratory finishing machine completed 2,100 pieces in one hour.

Deburring aluminum aircraft nut. Hand work and 16 hours tumbling formerly required to remove internal burrs and break edges. Vibratory finishing was satisfactory in two hours.

Deburring copper alloy electronic component. Hand work needed to remove piercing burrs which were rolled into the holes by conventional tumbling. Vibratory finishing eliminated the hand operation and reduced the tumbling time from four hours to one.

Deburring and radiusing electrical iron stamping. Sixteen hours tumbling failed to produce the radius required on recessed, shielded edges. The vibratory finisher's result was satisfactory in five hours.

Deburring and radiusing stamping. This transistor mounting flange required .020 inch radius on inside edges. Conventional tumbling reduced all dimensions excessively. Vibration produced the radius, but held other dimensions within tolerance.

Deflashing molded plastic. Flash completely removed from inside diameters, using steel media. Five minutes in a vibratory finisher.

Deburring threaded ring. Mill and drill burrs in recesses and threads required tedious hand-filing, scraping and brushing to deburr and blend. Vibration eliminated 90 per cent of the cost.

Deburring stampings. These stampings typified parts prone to tangling and deformation in tumbling. They were successfully finished in a vibratory finishing machine without tangling or bending.

It is conceded that vibratory finishing equipment is subject to the same problems of impingement and peening that have been perennial hazards in simple tumbler finishing. In some cases, even with the improved precision controls made possible by the vibratory process, adjustments may be beyond the experience and capability of even experienced finishing personnel.

But in most cases vibratory finishers improve quality and cut costs of production.

The vibratory process accomplishes a sharp increase in the precision control suited to the constantly growing intricacy of machine parts, to the employment of non-ferrous metals, new alloys, and to the growing use of plastics.

The effect of the new process is to double or multiply the efficiency of barrel finishing in the light of today's complex and diverse industrial demands. • • •

SAM SAFETY SAYS:

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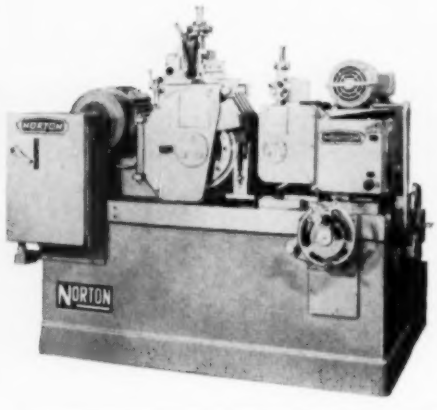
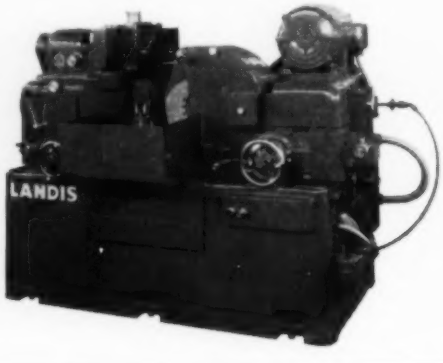
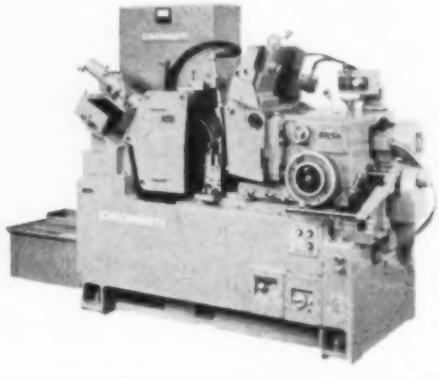






Centerless: high production OD grinding part II

machines, attachments, set-up

RICHARD L. McKEE • Managing Editor

As machine tools go, a centerless grinding machine is fairly simple in design. Rigidity is its prime requirement. Major makes of machines, their components, and the relationship of these components in machine set-ups are of extreme importance.

● Centerless grinding machines are relatively simple in design, in comparison with many metalworking machine tools. The problems come in meeting their twin requirements of high output and extreme accuracy. Each manufacturer has solved the difficulties of arrangement and support of the basic components of a centerless grinder in his own fashion, and it is not within the scope of this discussion either to compare or to evaluate the solutions.

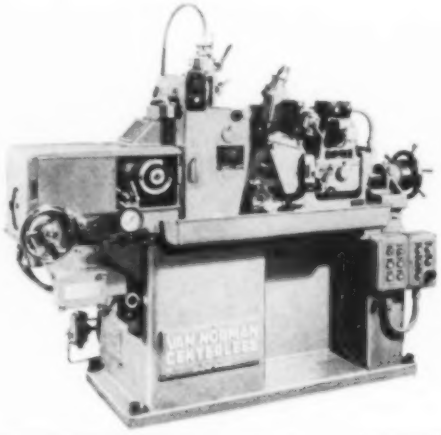
The location of the grinding wheel relative to the other major components, the location of dressing devices and the relative merits of different types of spindles, however, are matters of considerable importance. Hence photographs of grinders of the leading manufacturers are included, with brief specifications in the captions.

Of basic interest in the operation of a centerless are such areas as work loading and holding devices, work blades, and machine setup and adjustment (in this article); and grinding wheels, coolants, and dressing and truing (next month).

Loading Devices

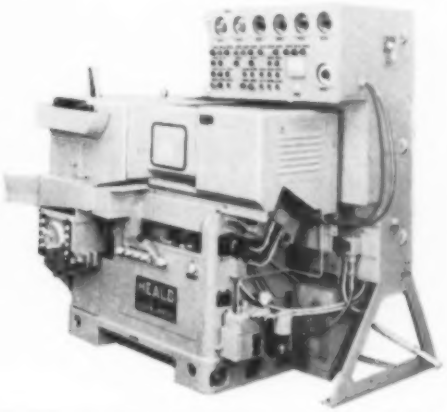
The most popular loading device for both through-feed and in-feed centerless grinding, though not necessarily the most productive, is the human hand. In job shops the variety of work often hinders the use of mechanical loading. In high-production lines, the shape or weight of the piece may dictate hand-loading.

On the other hand, safety has spurred the development of loading devices for in-feed grinding, and there has been an encouraging increase in mechanical through-feed loading, par-



Norton Company's No. 2 straddle bearing centerless grinder. Work capacity—1/16" to 4¾"; solid bars to 10' long—½"-2"; hollow bars to 10' long—½"-4" OD. Regulating wheel speed—8-66 rpm. Grinding wheel drive—15 hp; regulating wheel drive—1½ hp.

Cincinnati 220-8 Centuramic centerless grinder. Work diameter up to 4¾" (100 series—1½" OD; 300 series—6" OD; 400 series—10" OD with special fixtures). Regulating spindle speed infinitely variable from 11 to 300 rpm. Grinding wheel drive—20 hp. Others—7½, 25, 30 or 40 hp. Regulating wheel drive—1½ hp, all series except 100, which is ½ hp.



Royal Master TG-12 centerless grinder. Infeed and thrufeed capacity—1½" OD; 3' bars on fixture—1" OD; bars up to 12' on fixture with extension guides—⅝" OD. Spindle speed for grinding wheel—constant, 2100 rpm; regulating wheel—stepless from 30 to 480 rpm. Motor—5 hp.

Landis Tool Co. 12R centerless grinder. Work capacity—1/16" to 4¾" (8" with bar grinding work rest). Regulating spindle speed—10-90 rpm. Grinding wheel drive—15 hp (20 hp available). Regulating wheel drive—2 hp. (Truform dresser on regulating wheel is optional equipment.)

Van Norman 1C Diversimatic centerless. Infeed and thrufeed capacity—up to 1½" OD (Model 2C—up to 4¾" OD). Grinding spindle speed—1725 rpm; regulating—infinitely variable from 13 to 80 rpm in low range; 140 to 830 rpm, high range. Main drive—7½ hp; regulating wheel—½ hp.

Heald Machine Company's Model 190A Centri-Matic for centerless internal grinding of either straight or tapered bores. Maximum capacity—4½" OD, 1½" length (2" with special chutes). Minimum hole ground—⅛". Wheelhead motor—7½ hp. Work speeds—1200-825-750-490 rpm.

ticularly where several machines are used in tandem as a production unit.

For through-feed grinding, the objective of the loading device, whatever its mechanics, is to present workpieces in a continuous stream to the grinding wheels. In many cases it makes no difference which end goes first. In others, the loader must align the work in a certain manner and reject pieces that are going in backwards. This is a complication, but by no means an insoluble one. A variety of hopper and other mechanical feed units are illustrated.

For in-feed or plunge grinding, each piece must be laid on the work blade between the wheels in a specified manner, and lifted out after grinding. A number of these devices also are illustrated.

The selection of a loading or feed device must always depends on the production level of the part, its complexity, and the versatility of the feed. Another factor is the number of manhours to be gained by its use.

Work Support Blades

The work support blade is a unique and essential component in centerless grinding, though it may not be, strictly speaking, an accessory nor an attachment. It is also called the work blade.

Its length is determined by the width of the grinding wheel; it must be as long as the wheel is wide, to support the work across the grinding face. Its thickness depends on the diameter of the work. For small-diameter work the blade should be only slightly thinner than the work. Thicker blades provide better support for large diameter work; the thickest blades used are ⅝" to ¾" thick.

The top of the blade is generally finished at a 30° angle. The steeper the angle, the faster is the rounding action. Too steep an angle, however, causes excessive and undesirable side pressure against the blade, which is usually counterbalanced by reducing the blade angle to 20° or 25°.

A blade with a V-shaped top is used on the Lidkoping grinder, but during operation the work is held against one side of the vee.

Even more important than top angle of the blade is the material, which depends to a considerable extent on the workpiece material. Since the top is in continuous contact with rapidly rotating workpieces, conditions are severe, and the wear surface of the blade must be able to withstand the friction and the effect of bits of

continued

CENTERLESS

continued

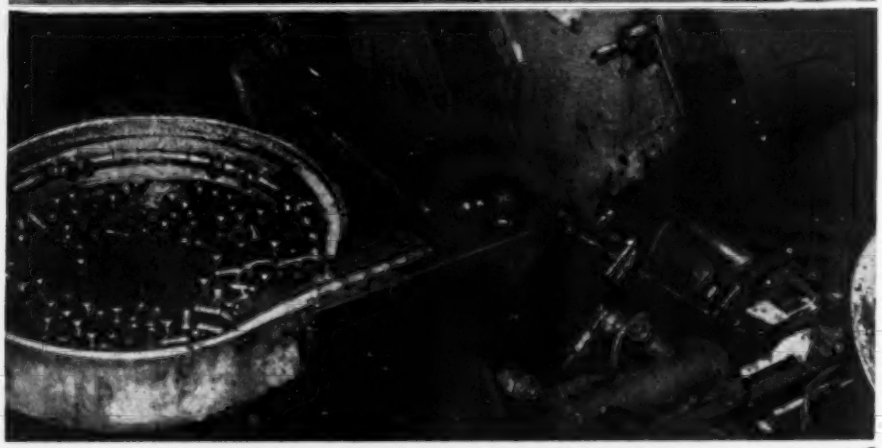
abrasive or chips in the coolant stream. Materials that have a tendency to cut or pick up surface material from the workpiece, of course, cannot be used. The finish secured with centerless grinding depends to a great degree upon the material used for the work blade's wearing surface.

These considerations seem to dictate the hardest possible materials, and in general this is so. It is always advisable to start with a hard material and to compromise if "picking up" becomes a problem.

A range of materials from sintered carbides to hard rubber and fiber has been used successfully, depending on the workpiece material.

Sintered carbide inserted blades are probably the most widely used. They are suitable for case hardened or oil hardened steels, for stainless, and nonmetallic materials—plastics, glass, and similar substances. Carbide inserts are higher in first cost, but lower in cost per piece ground, because the blades require fewer regrindings.

Grinding the diameters of pinion gear pins with automatic hopper feeder unit and conveyor, thrufeed on 2 machines, at 2600 per hour.



Hopper feeding for thrufeed grinding is a common practice with parts such as these inner races of roller bearings. Diameters range up to about 7/8".

Automatic transfer arm carrying worpiece to grinding position. Round files are ground at the rate of 300 per hour.

Manually-fed plunge grinding. Both wheels and the work support blade are formed to fit the various diameters of the shaft.

Infeed-thrufeed grinding. Air-actuated rod pushes parts into place; regulating wheel and coolant stream from back holds them; rod retracts at end of cycle, pushes new parts to eject finished parts.

In shops where frequent reshaping of the blade is a necessity—job shops are good examples—high speed steel is often preferred because it costs less for regrinding. High speed steel is well-adapted to non-ferrous metals, to parts which vary in hardness from one end to the other, and to very small diameter work.

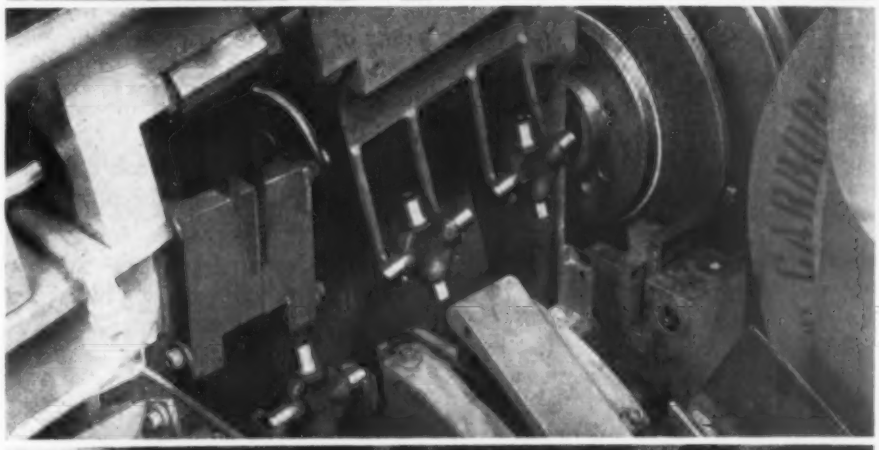
Cast iron, meehanite, and hard bronze are often used for soft steels, to eliminate "pick up" between the work and the blade.

In the production of some of the fine rms finishes, fiber and hard rubber capped blades are satisfactory.

Auxiliary Support

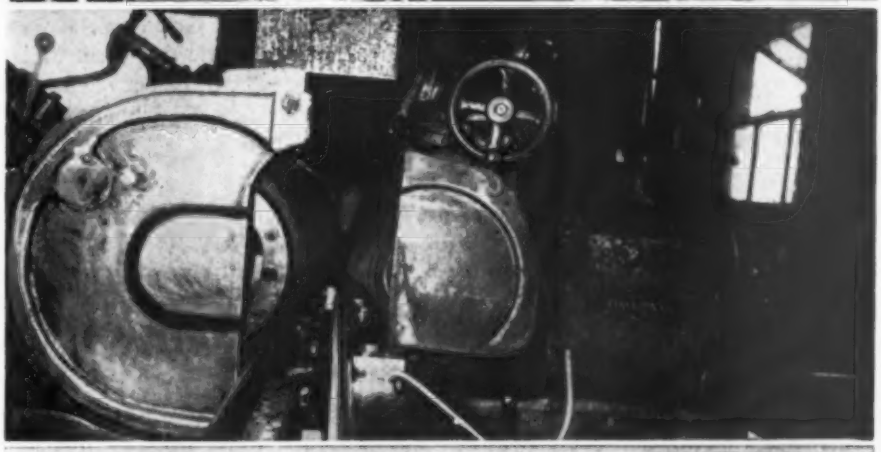
Outboard supports are essential in bar grinding and in similar applications involving overhanging parts. These may be as simple as a couple of narrow tables ahead of and behind the grinder, to hold rods steady and in line during grinding. They may be as complex as a powered fixture which helps to rotate heavy bars or tubes, and then by a flip of a switch, after the pass is complete, reverses the direction of the bar and sends it

continued



Automatic loading and unloading for plunge grinding two diameters of Pitman shaft gear. Work piece being loaded to grinding position.

Work loader with magazine type feed and indexing unit for turning the workpieces to grind the four diameters of universal joint spiders.



Close-up from the back end of a grinder shows angled top of work support blade. For large-diameter parts, a thick blade is used.

Feed end of grinder shows work guides and outboard supports for bar grinding. A similar set-up must be provided on the exit side.

Centerless with bar grinding attachment. As first pass ends, the regulating wheel reverses, causing the bar to reverse direction for a second pass along its full length.

CENTERLESS

continued

back through the grinder to its starting point.

Generally, however, they are simple rests with rollers in sets of two, and of a length suitable for the work. Sometimes a third roller for holding down the work may be added, but this is unnecessary for long work.

A top plate or rail is advisable for grinding very small diameter work, both to prevent the pieces from riding up on each other and to keep them from climbing up the grinding wheel face. The top rail is of about the same length as the work blade, has just enough clearance to permit the work to pass through.

A top rail can also be effectively used on through-feed work whose diameter is greater than its length. Such pieces are inclined to tip over when any irregularities come in contact with the grinding wheel. A top rail effectively holds them square.

Machine Setup

Two critical parts of machine setup are the relationship of the work blades and the center line of the wheels, and the alignment of the front and rear guides.

It has been said that faster rounding action results from increasing the vertical distance between the center of the work and the center line of the wheels, up to the point at which the work tends to jump or spin away from the blade. This provides an automatic maximum height.

A good rule in setting up small-diameter work is to adjust the work blade vertically so that the center of the work is above the center line of the wheels by a distance equaling one-half the work diameter. For larger work the above-center adjustment rarely exceeds ¾", excepting for thin-walled work.

Contrary to usual practice, long steel rods or tubes are successfully ground with the center of the work below the center line of the wheels. This eliminates whipping or chattering of the bar, as it is firmly held down on the work blade by the wheels themselves. However, bars should be straight before being ground, as they cannot be readily straightened on the grinder.

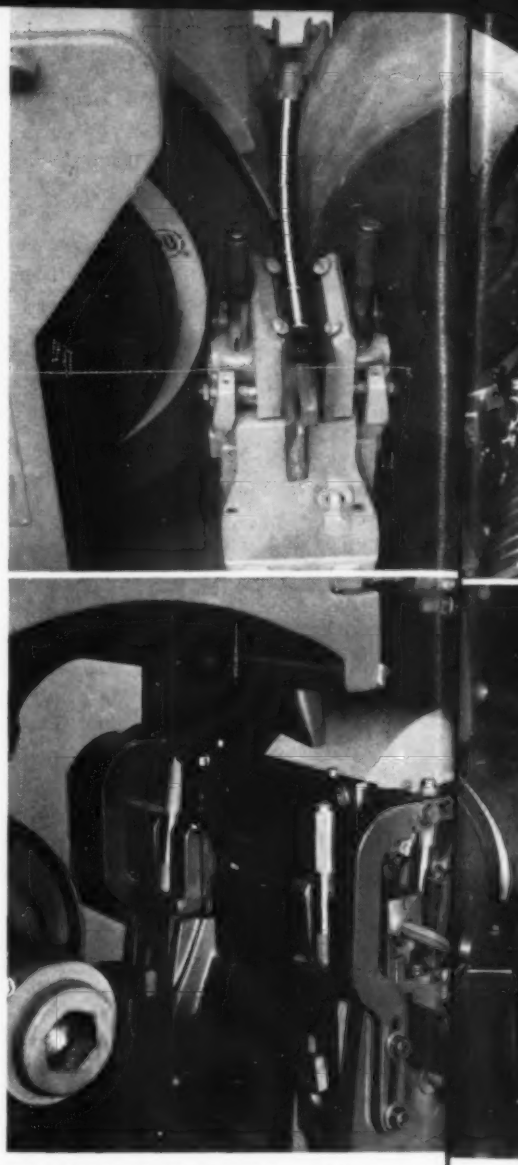
Guides on through-fed work should be positioned to permit the work to slide through freely without striking the edge of the wheel or the guide. The bearing surface of the front guide is located behind the effective surface of the regulating wheel by an amount roughly half the stock to be removed during the pass through the machine. The rear guide is set back from 0.0005" to 0.001". In this way spinning of the work is prevented.

Clearance between the work and the guides adjacent to the grinding wheel is about 0.015" to 0.030", depending on the workpiece diameter. Length of the guide varies with the length of the work.

The faces of the guides should be parallel with those of the grinding and regulating wheels. Guides deflected toward the regulating wheel to to produce barrel-shaped work, while deflection toward the grinding wheel produces an hour-glass shape. While these are objectionable on most work, such setups can be used to advantage when concave or convex taper is desired.

Proper machine setup, in detail, is much too complex a subject to be covered in the space available. Further, it needs to be discussed in terms of particular machines, not of centerless grinders in general.

Suggested adjustments in case the work is not up to standard are, however, much more general. The following list of corrective adjustments is from **Centerless Grinding—Theory-Principles-Applications,** a forthcoming revision of **Principles of Centerless Grinding,** by The Cincinnati Milling Machine Company.



Thrufeed grinding radii on the ends of roller bearings, at 2400 per hour. Angling the guides toward the regulating wheel produces the radii.

Thrufeed grinding with an overhead guide, for thin parts or parts with pointed ends. Guide restrains parts from losing contact with work blade.

Corrective Adjustments

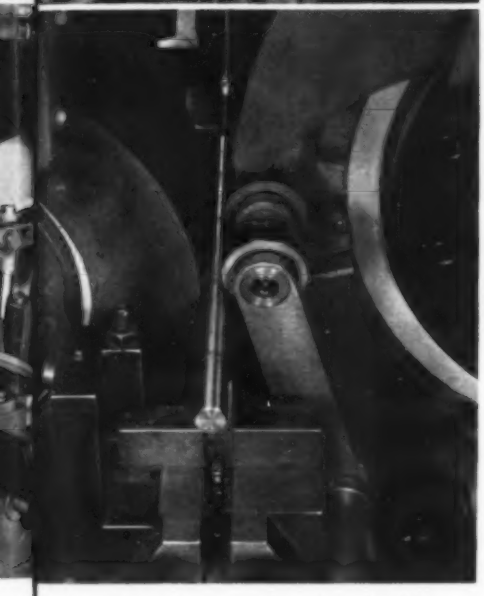
(B) BARREL-SHAPED PARTS
- Work guides deflected toward regulating wheel
- Face of regulating wheel not straight at work control point (Truing device worn, or not set at proper angle)

BURN MARKS ON WORKPIECE
- Insufficient cutting fluid on workpiece
- Dull or flat diamond
- Wheel too hard
- Cutting on trailing edge of the wheel
- Grinding wheel dressed with too slow a diamond traverse rate

(C) CHATTER
- Work too high above center
- Wheel out of balance
- Blade angle too steep (30° standard)
- Too thin or a warped blade
- Machine leveling screws not adjusted for even torque when machine is finally leveled
- Glazed wheel caused by dull diamond, too hard a wheel, too fine a grit size or too slow a dressing rate
- Outside "Floor Harmonics" (vibration)
- Motors out of balance
- Grinding wheel mount fits loosely
- Too heavy a stock removal
- Blade not properly clamped
- Blade too long for width of wheel

(D) DULL DIAMOND
- Diamond nib not turned periodically
- Excessive infeed of diamond (should not take more than .001 depth of cut under normal conditions)

(E) ERRATIC SIZING
- Gibs not properly adjusted on upper and lower slides



In this set-up a pipe tee doubles as coolant outlet and top guide. A few thousandths above the work, it holds work square, keeps it from jumping.

Adjustable powered hold-down rollers mounted to work rest hold work in place for plunge grinding diameter and radius at 350 pcs. per hour.

Wear in infeed screw and nut
Infeed lever not held tight (for thrufeed work)
Soft wheel
Insufficient lubrication on lower slides causing slides to hang or jump (infeed)
Improper tension on backlash spring
Loose work support blade
Parts over heating due to improper wheel or insufficient flow of cutting fluid
Regulating wheel camming
Work improperly roughed

(F) FEED LINES

Grinding Wheel not relieved on exit side
Work guides not properly set
On long bar fixtures, excessive pressure on workpiece by roller hold down
Cut not proper across wheelface

FINISH

Improper wheel grade
Dirty or insufficient cutting fluid
Setup not correct
Too fast a diamond dressing traverse
Erratic movement of truing attachments
Pick-up on blade
Blade not tight in work rest
Blade angle too steep
Unbalanced wheel
Loose, cracked or dull diamond
Oil on face of wheel
Regulating wheel not tight on mount
Work too high above center
Regulating wheel s.f.p.m. excessive
FISH TAILS
Dirty cutting fluid
Loose grit in wheel

(G) GRINDING WHEELS—Too Hard

May cause burn marks
Can cause squeal because it is not free cutting
Glazing may occur on wheel face
Soft materials may "load" wheel
Often produce chatter on workpiece
Sizing trouble, no spark out
May cause heat checks or cracks
GRINDING WHEELS—Too Soft
Sizing trouble, because wheel breaks down rapidly
Chatter may develop

(H) HEIGHT ABOVE CENTER OF WORKPIECE

If too high chatter can develop
Optimum rounding action will not occur if center height is too low

(I) INTERMITTENT CUT

Grinding wheel not correctly trued
Regulating wheel "camming"
Warped workpiece

(J) JUMPING TRUING DEVICE

Air in lines (hydraulic)
Slides not lubricated properly
Gib adjusted improperly

(L) LOADING OF WHEELS

(See grinding wheels)
Wheel too fine. Larger grain size allows more chip clearance
Ineffective cutting fluid—due to the lack of lubricity of cutting fluid chips adhere to grit of wheel. Change to coolant with greater lubricity or increase amount of concentration in mix.
LOW ENDS ON WORK (chamfering)
Work guides deflected toward regulating wheel
Face of regulating wheel not straight at work contact point
(Truing device worn or not set to proper angle)

LOW CENTER

Work guides deflected toward grinding wheel
Face of regulating wheel not straight at work contact point (Truing device worn, or not set to proper feed angle)

(N) NICKS IN WORKPIECE

Parts dropped into tote pans. Provide bumpers to cushion workpiece

(O) OUT OF ROUND WORK

Out of balance workpiece
Work not high enough above center
Workpiece bowed
Regulating wheel not dressed round
Regulating wheel loose on mount
Blade angle not steep enough
Not enough stock to round up
Regulating wheel speed too slow
Interrupted cut due to keyways, holes, flats
End stop or ejector may be worn on locating surface (infeed only)
Grinding wheel off grade
Flat diamond

(P) PICK-UP ON BLADE

Cutting fluid not lubricating work-to-blade contact point. Use cutting fluid with greater lubricity or increase concentration.
Blade material (try cast iron or bronze blade)

(R) REGULATING WHEEL "CAMMING"

Collet screws loose
Bearings worn
Regulating wheel spindle eccentric or out of round

(S) SIZING (See erratic sizing)
"SPIRAL CHATTER"
Hard spots in wheel
Chipped edge of wheel
Loose machine elements
STRAIGHTNESS
Work not straightened sufficiently before grinding
Insufficient grinding stock left on workpiece
Too much stock removal on first pass
Wheel not cutting freely. (Part heats up, relieving internal stresses causing parts to bow.)
Insufficient cutting fluid

(T) TAPER

Work guides not set properly
Dirt under work rest or blade
Loose gibs
Failure to keep parts butted end to end on thrufeed
Too much feeding pressure (race-grinding fixture)
Non-uniform spark-out time from one piece to the next (infeed setup)
Wheel not cutting freely (Part expands due to surface temperature immediately behind leading end. This results in tapered part with leading end high)

(V) VIBRATION

Check outside sources
Leveling screws not snug against floor
Motors not balanced or drive belts too loose
Faulty hydraulic pump causing erratic pressure vibrations to be transmitted to machine

(W) WARPED WORK (usually long bar or tubing)

Insufficient flow of cutting fluid
Wheel not cutting efficiently. Either dressed too fine or too small grit size
Work piece not straightened before grinding

This is the second article of a four-part series on centerless grinding. The first article, in October, covered the advantages of centerless grinding, centerless principles, feed methods, and broad areas of application. The third will discuss wheels, coolants, dressing and truing; and the fourth, centerless belt grinding, internal centerless grinding, centerless thread grinding, and job shop operations. Tear sheets of individual articles will be available as long as the supply lasts, and reprints of the series will be ready for distribution about a month after the publication of the last article.

Photographs courtesy Ace Grinding and Manufacturing Co.; Chain Belt Company, Shafer Bearing Division; Cincinnati Milling Machine Co.; Heald Machine Company; Landis Tool Company; Norton Company; Royal Master Grinders, Inc.; and Van Norman Machine Company.

End Mill usage reduced by 83%

By C. A. McQUARRIE, Everett Plant, General Electric Company

Increase in cost of redesigned end mills is more than offset by reduced grinding time and end mill usage. Savings on one type of double end mill in first seven months equaled $12,100, plus time savings at the rate of 900 man-hours per year.

● The maintenance of standard end mills used on high production is an extremely expensive operation. At General Electric's Everett, Mass., plant a small change can mean considerable savings. A major change in tool design, while increasing the cost of the cutters, has greatly reduced grinding time and increased the life of the tools an average of five times over the old design.

This facility is part of the company's large Jet Engine Department, headquartered near Cincinnati. The major efforts of the Everett plant are directed at the manufacture of sheet metal jet engine components. Some of the cutters are used for a 3/16″ depth of cut.

Problem:
Reduce grinding costs.

Previous conditions:
Resharpen entire length of end mills.
90% mill lost through grinding.

Solution:
Establish depth of cut for types of mills used.
Notch O.D. in sections according to depth of cut.
Drill relief hole the entire length of flute for end grinding.
Resharpen as required only to next notch.
When usable number of resharpenings have been completed, used end is cut off at notch and new end cutting teeth are roughed in and finish ground.

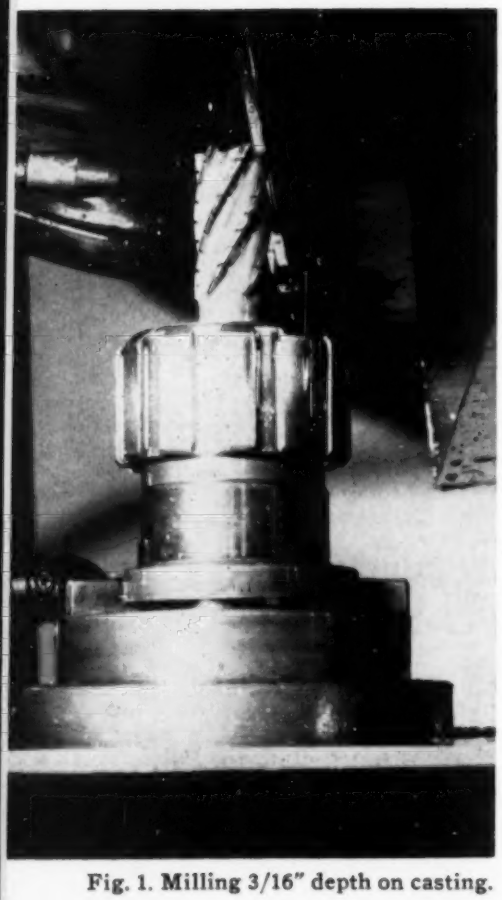


Fig. 1. Milling 3/16″ depth on casting.

Example of grinding time savings:

Old Method	New Method
8 mins. O.D.	4 mins. O.D.
4 mins. End	4 mins. End
10 mins. Radius (true .005-.015)	10 mins. Radius
5 mins. Handling & Setup	5 mins. Handling & Setup
2 mins. Drill ½″ Chip relief (8 minutes every fourth grind)	0 mins. Drill ½″ Chip relief
—	—
29	23
x 2 (Double End)	x 2
—	—
58 mins.	46 mins.
	900 man hours savings per year.

Example of tool cost savings:

The following shows actual seven months cost to purchase tooling made to special drawings previous to the introduction of the new grinding method, versus the cost of new tooling designed to facilitate and reduce grinding time and increase the life of the tools themselves.

Old Style	New Style
1⅝" Single End Mill	1⅝" Single End Mill
12 x $13.25 = $159.00	12 x $21.50 = $258.00

Initial cost of new style end mill is higher than that of old style, but we are getting three (3) end mills for price of one (1) or—

36 x $13.25 = $477.00 (old style)
12 x $21.50 = $258.00 (new style)

(Savings) $219.00

Old Style	New Style
1⅛" Double End Mill	1⅛" Double End Mill
12 x $27.80 = $334.00	12 x $29.48 = $354.00

Initial cost of new style end mill is higher than that of old style, but we are actually getting eight (8) end mills for price of one (1) or—

96 x $27.80 = $2,669.00 (old style)
12 x $29.48 = $ 353.00 (new style)

(Savings) $2,316.00

Old Style	New Style
1⅛" Double End Mill	1⅛" Double End Mill
18 x $27.95 = $503.00	18 x $29.48 = $531.00

Initial cost of new style end mill is higher than that of old style, but we are actually getting ten (10) end mills for price of one (1) or—

180 x $27.95 = $5,031.00 (old style)
18 x $29.48 = $ 531.00 (new style)

(Savings) $4,500.00

Old Style	New Style
⅝" Single End Mill	⅝" Single End Mill
36 x $6.00 = $216.00	36 x $9.25 = $333.00

Initial cost of new style end mill is higher than that of old style, but we are actually getting five (5) end mills for price of one (1) or—

180 x $6.00 = $1,080.00 (old style)
36 x $9.25 = $ 333.00 (new style)

(Savings) $ 747.00

Old Style	New Style
1⅛" Double End Mill	1⅛" Double End Mill
48 x $14.95 = $718.00	48 x $29.48 = $1,413.00

Initial cost of new style end mills is higher than that of the old style, but we are actually getting sixteen (16) end mills for price of one (1) or—

384 x $14.95 = $5,731.00 (old style)
48 x $29.48 = $1,413.00 (new style)

(Savings) $4,318.00

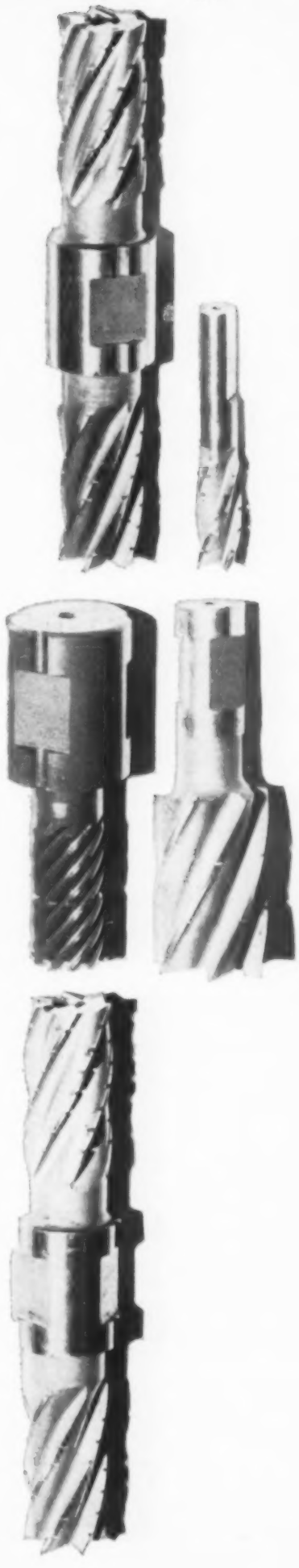
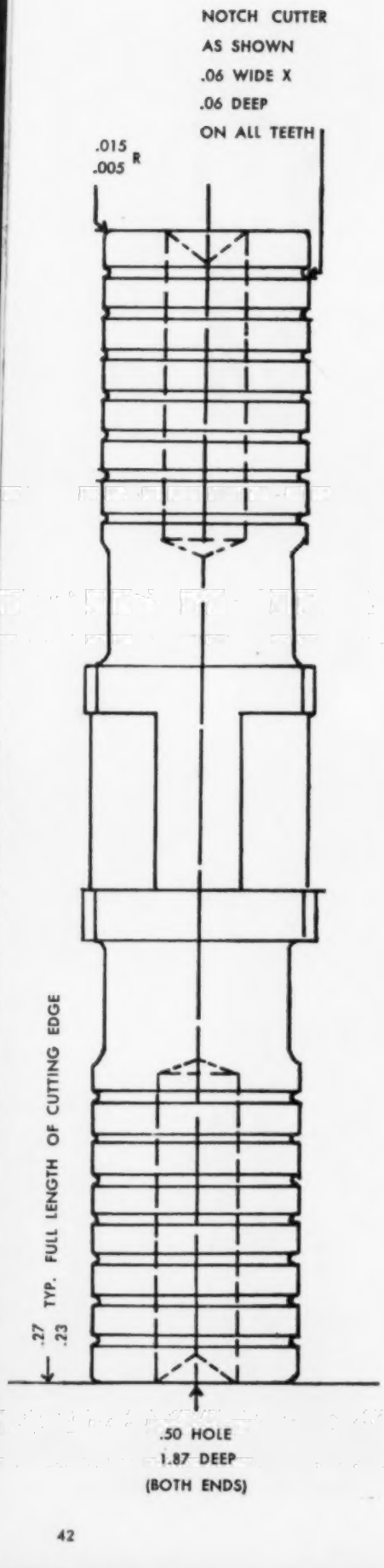


Figure 2. Examples of types of end mills



END MILL USAGE

continued

Old Style	New Style
1″ Single End Mill	1″ Single End Mill
39 x $33.14 = $1,292.00	39 x $38.08 = $1,485.00

Initial cost of new style end mills is higher than that of the old style, but we are actually getting two (2) end mills for price of one (1) or—

78 x $33.14 = $2,916.00 (old style)
39 x $38.08 = $1,485.00 (new style)

(Savings) $1,431.00

Total Number End Mills (Old Style) 954
Total Number End Mills (New Style) 165
Total Cost (Old Style) $16,473.00
Total Cost (New Style) $ 4,373.00

Savings Total $12,100.00

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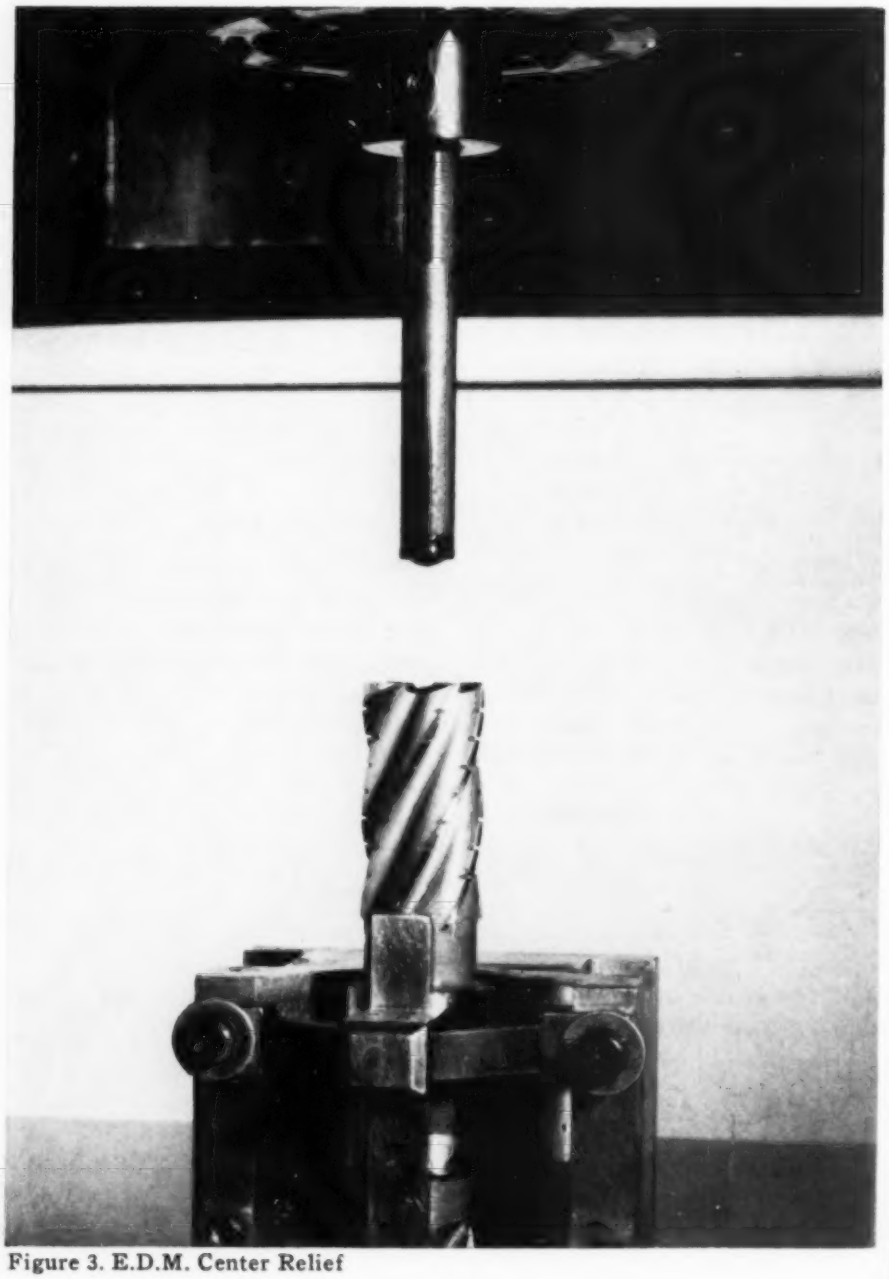


Figure 3. E.D.M. Center Relief

"TOOLS THAT SHAPED AMERICA"

New Film from GWI

The Grinding Wheel Institute has just released a 16mm sound color motion picture about the importance of abrasive wheels. It is entertaining and educational for both inexperienced and experienced audiences.

Reed Hadley, national TV star, is shown in a scene from the Grinding Wheel Institute film, 'Tools That Shaped America." The film dramatically illustrates the role played by abrasives in our nation's development.

● "Tools That Shaped America" dramatically portrays the historical importance of grinding wheels in the development of the nation. It graphically illustrates the solution to the question, "Why not grind the work instead of the tools to machine the work?" It weaves together the integrity of the grinding wheel manufacturers and the responsibility of users for safe, efficient use of abrasives.

Featuring Reed Hadley, a national TV star, the film starts with the historical development of metalworking in this country, pointing out the role played by individuals and the effect upon us by abrasives. The author, William D. Ellis, skillfully ties this history to present applications. At this point the present importance of abrasive machining is emphasized.

A factory scene in which an engineer is able to convince his management of the importance of abrasive machining, leads into a film within the film, an excellent presentation on safety. First it shows the length to which grinding manufacturers go in order to provide a safe product and then the importance of proper handling of the wheels by users. This is followed by a discussion of the three "G's," gloves, goggles and guards.

The Grinding Wheel Institute is a non-profit association of grinding wheel manufacturers of the United States organized for the development of safe and efficient grinding practices. The new film is available for showing before interested audiences on request to the Grinding Wheel Institute, 2130 Keith Building, Cleveland 15, Ohio. It is intended primarily to be of interest to plant management, designers, engineers, safety directors and to operators or the actual users of grinding wheels.

The movie was produced by Cinecraft Productions, Inc., Cleveland, Ohio. Running time: 32½ minutes.

WHY

RESINOID WHEEL FILLERS

By N. P. ROBIE, Manager of Research
Electro Refractories & Abrasives Corporation

Inorganic materials which are neither abrasive nor bond have significant effects on the grinding action of resinoid grinding wheels. This article summarizes current theories, though the complete explanation is not known.

● Large quantities of inorganic minerals and salts are commonly used in the manufacture of grinding wheels. In vitrified wheels, the role of minerals such as clay, flint, and feldspar is obvious, since ingredients like these make up the bond prior to fusion by firing.

Less obvious is the role of such minerals and inorganic salts in resin-bonded wheels, in which the bonding resin is an organic combustible material which they modify even though they are not fused during the baking operation.

Though these additives are neither abrasive nor bond, they have been found to affect very materially the performance of the grinding wheel.

The first resin-bonded abrasive wheels were made using relatively inert fillers such as clay and flint. The phenolic resins first used for abrasive wheel bonding were very expensive. Blending in low cost fillers such as clay and flint with the expensive resin had the advantage of reducing the cost of the wheel.

Later it was found that natural Greenland cryolite additions gave much improved grinding efficiencies. Cryolite, a sodium aluminum fluoride mineral, rapidly achieved wide usage in resin-bonded wheels. It was the first chemically active filler extensively used. We now know that thermal reactions are possible with cryolite at grinding line temperatures particularly in the presence of carbon and moisture from the decomposing resin. Hydrogen fluoride is one possible decomposition product.

Numerous theories have been suggested for using inorganic additives in phenolic resin bonds for abrasives. It is probable that no single theory explains why the use of certain inorganic fillers is desirable. It is probable that different theories and mechanisms apply to different materials.

The theories for using inorganic fillers can be summarized as follows:

1. Certain porous fillers such as pumice, perlite (expanded siliceous volcanic rock) and "Kanamite" (fused clay spheres) can be used to introduce porosity into a wheel. Fillers of this type can also influence wheel grade and can produce "soft," fast-cutting characteristics.

2. Certain fibrous fillers such as asbestos and glass fibers are used to increase the strength and speed safety of wheels. Asbestos is commonly used as short fibers and the glass as open mesh woven cloth. Open mesh glass cloth is now extensively used to reinforce thin cutting-off wheels and depressed center snagging discs.

3. Some additives influence resin reactions and therefore resin properties. Resin polymerization, for instance, is catalyzed by alkaline conditions and a filler like lime would provide alkalinity to promote polymerization of base-activated resins. Other fillers such as lead oxide and certain colloidal hydrous oxides are said to be reactive with the phenol acid groups of the phenolic resin.

4. Fillers may be used to take care of water from condensation. Some fillers such as lime, calcium sulfate, active magnesium oxide or activated alumina react with or absorb evolved water of resin condensation polymerization. Fillers may be used to reduce the amount of resin needed to bond dense structures. Reduced resin means reduced

continued

WHEEL FILLERS

continued

water of condensation polymerization which decreases the tendency of dense structures to swell during the bake.

5. Fillers which physically modify the resin bond strength and adhesion alter grinding wheel cutting action and efficiency. The ratio of resin to filler can be changed over a wide range, limited by safety considerations, to vary both speed of cut and wheel wear.

6. Fillers may provide lubrication at the grinding line. These fillers should not be refractory. Low melting metals and alloys have been suggested. Salts or eutectic mixtures of fillers melting below grinding line temperature have been suggested.

7. Fillers may take part in reactions at the temperature of the grinding line. These reactions may occur between two or more fillers, between filler and abrasive, between filler and bond, or between filler and the metal surface being ground. Most materials with melting points above 1200° C are not effective as reactive fillers.

The reactions may take place when the filler is in the solid, molten, or decomposed form. Often filler mixtures are used where one filler may have a fluxing action on others or may form a lower melting eutectic. Beside the heat of grinding, the filler reactions may be promoted by the presence of carbon and moisture from the decomposing resin binder.

Decomposing fillers may weaken the bond, thereby releasing worn abrasives and minimizing wheel dulling and glazing. Such fillers may be used in dense wheel structures to speed metal removal while maintaining suitable life.

Decomposing fillers may provide more efficient acidic grinding atmospheres. Experiments have proven that grinding efficiency in inert atmospheres like nitrogen is poor. Stainless steel is more resistant than common steels to the common grinding atmosphere oxygen. It is well known that the efficiency of grinding stainless steel is improved by the use of fillers providing sulfur, chlorine, or fluorine at the grinding area of contact.

The surface influence of sulfur and the halogen compounds on metal being ground can doubtless be compared to the presence of these elements in high pressure lubricants, grinding fluids, and soldering fluxes where surface reactions with metals and their oxide films are also important.

8. Fillers can modify the heat resistance of the bond. They may change

TABLE I

Grinding Wheel Filler Patents

Patent Number	Date	Filler Composition
Brit. 444,141	3/16/36	Cryolite in shellac bonded wheels
1,576,122	3/9/26	Plaster of Paris
1,984,423	12/18/34	Manganese dioxide ammonium chromate, ammonium dichromate, potassium permanganate and sodium permanganate
2,022,893	12/3/35	Isoluble fluoride, CaF_2, Cryolite
2,033,668	3/10/36	Wheels impregnated with zinc chloride or other delequescent salts including calcium chloride
2,083,719	6/15/37	Lead oxide
2,110,630	3/8/38	Cryolite
2,197,552	4/16/40	Selenium, tellurim and their sulfides
2,216,135	10/1/40	Alkali and alkaline earth chlorides and carbonates M.P. 700-1200°C
2,243,049	5/20/41	Anhydrides and acid salts of sulfuric and phosphoric acid including sodium bisulfate
2,249,278	7/15/41	Inorganic dehydrating agents CaO, $CaSO_4$, activated alumina
2,258,774	10/14/41	Powdered lead, tin, copper and alloys of lead, tin and copper. Low melting.
2,294,239	8/25/42	Reactive MgO. Calcined magnesite
2,308,981	1/19/43	Iron sulfide
2,308,982	1/19/43	Potassium calcium sulfate. Potassium sulfate
2,308,983	1/19/43	Alkali metal fluoborate
2,325,180	7/27/43	Heavy metal sulfide including iron, manganese and molybdenum
2,371,700	3/20/45	Resin reacted with metal oxide of group consisting titanium, vanadium, chromium, manganese, iron, cobalt or nickel
2,371,915	3/20/45	Resin blended with colloidal hydrous metal oxides
2,408,319	9/24/46	Iron sulfide and potassium borofluoride together
2,638,413	5/12/53	Lead halide. Lead sulfate
2,729,553	1/3/56	Calcium, magnesium and barium fluoride with lime or magnesia
2,734,812	2/14/56	Porous or hollow particles. Foamglass. Expanded Perlite
2,745,728	5/15/56	Coated sulfur particles
2,780,534	2/5/57	Antimony sulfide
2,806,772	9/17/57	Thin wall hollow ceramic spheres
2,811,430	11/29/57	Zinc sulfide with alkali metal salt of H_2SO_4, HCl and HBr
2,874,034	2/17/59	Expanded micaceous mineral. Expanded vermiculite
2,939,777	6/7/60	Lead sulfide with alkali metal salt of H_2SO_4, HCl and HBr
2,940,841	6/14/60	Antimony sulfide with alkali metal salt of H_2SO_4, HCl and HBr
2,940,842	6/14/60	Silicon alloy with iron, manganese, aluminum, chromium nickel, vanadium, tungsten and zirconium
2,949,351	8/16/60	Cryolite, ammonium chloride and iron
2,952,529	9/13/60	Cryolite with ammonium chloride

the thermal conductivity of the bond to alter the rate of heat flow away from the grinding line. The fillers may have a fireproofing action on the resin binder. The decomposition temperature of the inorganic filler will influence the heat resistance of the bond mixture of filler and resin. We can use fillers of high heat stability like flint or fillers of low heat stability like potassium fluoborate.

9. Fillers can modify the coefficient of expansion of the bond mixture of filler and resin. The coefficient of expansion together with thermal conductivity of the bond is of importance in formulating a wheel to withstand sudden heat changes such as are encountered when heavy grinding is commenced with a cold wheel. The ratio of filler to resin in the bond is an important factor influencing the coefficient of expansion as well as the thermal conductivity of the bond. Zircon is an example of a filler with a low coefficient of expansion.

10. Low cost fillers blended with high cost resins will lower the cost of the bond mixture.

Typical examples of low cost fillers are flint, clay, iron sulfide, lime, and calcium sulfate.

The grinding wheel formulator is constantly seeking new fillers and new filler combinations to achieve the best grinding efficiency. Many filler patents have been issued as listed in Table I. Not all of these are used and there are many fillers and additives which are neither patented nor listed here.

5A	6A	7A
NITROGEN	OXYGEN	FLUORINE
PHOSPHOROUS	SULFUR	CHLORINE
	SELENIUM	BROMINE
ANTIMONY	TELLURIUM	

A study of the patented fillers listed in Table I shows that many of these fillers contain fluorine, chlorine, bromine, sulfur, antimony, tellurium, or phosphorous. The periodic table of elements assembles elements in vertical columns where the elements are much alike in chemical behavior. The elements listed fall in three adjacent vertical columns 5A, 6A and 7A as shown. This shows that these elements are close to each other in the periodic table and to the most common grinding atmosphere, oxygen in air.

It is interesting to note that the shaded elements are present in one or more of the patented fillers shown in the table.

Many reasons have been listed for using fillers in resin bonds. While no single filler can perform all of these functions, many of them play an important role in helping to achieve maximum grinding efficiency with adequate strength or safety and low cost. • • •

Preventing the contamination of coolants

● Contamination of industrial compounds and lubricants continues to be a costly—though unnecessary—problem in many metalworking plants. Despite every precaution taken by the lubricant manufacturer to assure the ultimate in purity-of-product, many users fail to insist on simple preventive maintenance procedures in the handling and dispensing of these compounds and lubricants.

Here are our suggestions for a preventive maintenance program which would result in substantial savings in the performance of such vital functions as grinding, forging, machining, rolling and machine lubrication.

In storing and dispensing of compounds and lubricants:

1 Select a clean, dry, enclosed area.
2 Appoint one person to be responsible for the storage and dispensing of lubricants from the oil storage room.
3 This person should also be responsible for the training of all men under his supervision to properly dispense all types of lubricating products.

We highly recommend centralized lubricating systems for lubricating moving parts of machines because they have proven to be so effective in the reduction of lubricant contamination. Modern portable dispensing units should be used to service these systems. This combination effects a 1) savings of labor, 2) reduction in lubricant waste and, 3) contributes greatly to "good housekeeping."

Where centralized lubricating systems are not adaptable or practical we recommend these handling instructions:

1 Thoroughly clean the tops of drums before removing bung or head.
2 Barrel pumps or bung spigots should be used for dispensing liquid products.
3 Thoroughly clean all containers, such as oil and measuring cans, pails, scoops, grease guns, pumps and so forth before using. Store them in a clean place when not in use. Never place them on the floor or other dirty surfaces.
4 Always check the product label or stencil on the original drum before removing its contents. This greatly reduces the possibility of using the wrong compound or lubricant.
5 Replace the drum head or bung immediately after dispensing the lubricant.
6 Never return lubricant, new or used, to its original shipping container.
7 Lids or covers should be fitted to all paste or fluid compound mixing tanks.
8 Good housekeeping at the mixing area should be maintained at all times.

Institute an educational program, with strict enforcement of rules prohibiting such bad practices as contaminating machine tool coolant sumps and tanks with food scraps, paper, oil absorbents, cigars and cigarette butts.

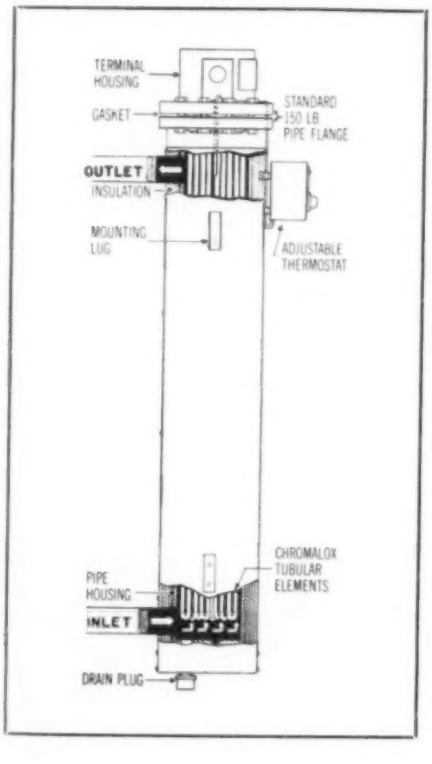
It is no wonder, that coolants become rancid and skin irritations occur when such conditions persistently exist. • • •

(Courtesy Kerns United Corporation.)

Heat Coolants?

The cooling effect of grinding lubricants has been their traditional function, as the common name, coolants, implies. Close-tolerance grinding, however, requires even coolant temperature, which may require heating as well as the customary refrigeration.

By WERNER S. EYTH • Edwin L. Wiegand Company



Copper-sheathed tubular immersion heater maintains accurate control through a range from 100°F to 175°F. Light 4-1/2" diameter assembly can be supported on inlet and outlet pipes.

● The cooling of lubricants in grinding operations has been a long-standing practice where tolerances are critical. But heating the coolant sounds like double-talk. Yet this is what is being done in many progressive shops.

Why? Perhaps the best way to answer the question is to cite a number of specific shop experiences.

A manufacturer of jet engine parts, producing large diameter shafts and hubs with a tolerance of 0.005", discovered that a too-cool lubricant was the cause of rejects. While these parts gaged to the specifications at the machine where they were given a final light grind, they ended up oversize on final inspection.

It was discovered that the lubricant used in the grinding operation was about 10 degrees below room temperature therefore cooling the work several degrees below this temperature. It was checked out that temperature of the coolant was responsible for at least 0.001" variation between readings at the machine and at final inspection.

Checking further, it was established that the coolant temperature fluctuated daily and seasonally, and varied from machine to machine.

This was attributed to variable heat losses, pumping rate of the coolant (3 to 5 gpm), coolant tank sizes (75 to 125 gal), temperature and volume of makeup coolant (15 gal per day) and operational factors which varied from machine to machine.

It was further determined that the coolant tanks buried under each machine were slow to warm up, particularly after a cool night; and evaporation occurred from the grinding wheel, the work, and the work table before the coolant drained back into its reservoir.

Evaporation alone was found to reduce the work temperatures from 1 to 3 degrees, equivalent to a 0.0001"-0.0003" work shrinkage.

Tooling engineers concurred that holding the gage temperature constant would be impractical. It was therefore decided to control the coolant temperature in relation to the gage temperature. And this required heating the coolant, with an allowance to compensate for the evaporative

To test this approach the company cooling.
installed a Chromalox electric circulation heater, rated at 6 kw, on one machine. This heater, a product of the Edwin L. Wiegand Company, Pittsburgh, was placed in the coolant line between the supply reservoir and the grinding head.

An indicating bulb and capillary controller on the grinder, with a sensing bulb in a T-fitting in the coolant line, automatically energizes the heater.

Temperature at the master gage is checked with a pyrometer hourly, and the controller is set at 2°F higher to compensate for the evaporative cooling. Admittedly this results in less-than-perfect conformity, but this control was found to be close enough to keep the work within the required tolerances.

The initial test with the heater installed was on 24 hubs, which were finish-ground, gaged at the machine, and then allowed to sit for 48 hours at room temperature. Gaged again, they were found to be within 0.0001" of the original gage reading.

This performance, backed up by another six months of careful checking, has resulted in the equipping of all finish grinding machines with Chromalox circulation heaters, resulting—because machined parts of this kind are expensive—in dollar savings.

Many users of Chromalox heaters on coolant lines prefer to keep their experiences as "shop secrets," feeling that it may give an edge to their company on production costs over their competition. But another example of how such an installation solved an operating problem can be cited.

A producer of high quality stainless steel sheet produces its own rolls for reducing and finishing mills. Here again it was found that the slightest change in the temperature of the coolant lubricant used in the precision grinding of these rolls affected their dimensional stability.

High speed tool steel rounds were being ground to what the company called a "zero" tolerance . . . exact 1.410 inch to 6.812 for the various rolls. And to grinding specialists, zero tolerances fall within the millionths of an inch allowance.

This user discovered that this "zero" tolerance could be consistently maintained when the coolant was held to a constant 92°F temperature. At this level, contraction and/or expansion was held to an infinitesimal minimum.

In this instance, the company installed a 6 kw heater in an under-floor 85-gallon coolant reservoir at each machine. Thermostats regulating their control were mounted in the heater head with the sensing bulb on each system installed in the liquid at the point where the coolant is pumped from the tank to the work.

Another machine shop, with knowledge of "heated" coolants on grinding machines, solved its indexing problems on automatic drilling and reaming machines by applying this principle to the lube oil. Thickened oil caused a heatup wait in the morning and at times slowed production during the day.

Installing a 6 kw, 480 v immersion heater, the user pumped oil continuously through the heater and machine during its working time, with a thermostat maintaining the temperature at a constant 100°F. The saving on this type of installation was rated by the user at about one hour's production per day.

Since shop experiences have shown that the temperature of a coolant can and does affect tolerances—with every degree of temperature change causing a size variation in a product, "heated" coolants are a possible answer to many present-day production problems.

• • •

Precision bar grinding with heavy duty soluble oil is an operation requiring coolant temperature control.

Control of coolant temperature with immersion heater helps maintain close tolerances in surface grinding.

INDUSTRIAL DIAMONDS, THEIR USES IN INDUSTRY

A program about industrial applications of diamonds was the center of attention at Pittsburgh's October 26 meeting and again at Long Island's November 8 session. John H. Olson, manager of technical services, Industrial Diamond Division, Engelhard Hanovia, Inc., was the speaker, with Erwin C. Winkelmann, sales engineer for Pennsylvania and Ohio, assisting in Pittsburgh.

The program consisted of a color sound movie on diamond mining and a 35 minute color slide presentation which included highlights from Engelhard Hanovia's research and development activities, shape count method on selected national diamonds for resin bond and metal bond wheel applications, charts and graphs on test results and applications of industrial diamonds.

A section of the presentation included information and slides about the sawing of concrete with diamond blades. A question and answer period followed.

Attendance at the Pittsburgh meeting was forty members and guests; at Long Island, it was not reported at press time.

John H. Olson

Eastern Massachusetts Chapter Organized

At a meeting held recently at the Framingham Motor Inn, the Eastern Massachusetts Area Chapter was established, with James M. Lynch, abrasive engineer, Heald Machine Company, Worcester, as president.

Other officers are Harold Timmons, professional engineer, Gillette Safety Razor, Boston, as vice president and John Fiske, Heald abrasive and tool specialist, as secretary-treasurer.

Serving on the board of directors are: Benjamin G. Longo, Gillette; Charles D. Peckham, Whitin Machine Works, Whitinsville; Stephen J. MacLean, United Carr Fastener, Cambridge; William E. Moody, Bay State, Westboro; and William H. Andren, Nelson Church Co., Wellesley Hills.

The chapter, which essentially replaces the Boston unit, encompasses all of eastern Massachusetts, including Worcester County.

Board Approves Chicago as 1962 Convention Site

Chicago was picked as the 1962 location by the national board of directors meeting at Philadelphia, November 12.

This will be a three-day session, with papers on abrasive machining to be presented on a Thursday and Friday, and the annual meeting on Saturday.

Firm dates have not been decided upon, but the sessions will probably be held either the last week in April or the first week in May.

Detroit Chapter Tours Michigan Abrasive Plant

Michigan Abrasive Company, Detroit manufacturer of coated abrasives, was host for a plant tour, the October meeting of the Detroit Chapter.

James M. Lynch

Saginaw Valley Explores Electrolytic Grinding

In a presentation before a group of some 27 at the Saginaw Valley Chapter's October 25 meeting, William R. Allen discussed the way in which the Anocut machine operates to assist grinding, and traced the history and development of Anocut Engineering Company.

His talk was supplemented by slides, and a question and answer period concluded the program. Allen is a regional engineer for Anocut.

Cleveland Checks Out Grinding Trends

Forty members and guests of the Cleveland Chapter welcomed James Hobbs, area district manager for Landis Tool Company, as their speaker on "Grinding Trends in Industry" at their November 9 meeting.

Latest Developments in Man-Made Diamonds

Connecticut gathered together a group of 84 for a presentation on man-made diamonds by Harry B. Weaver, Metallurgical Department, General Electric, and Leonard I. Smith, supervisor of diamond products, Norton Company.

Unusual Applications In Internal Grinding

Fred Thomas, project grinding engineer, Heald Machine Company, spoke on "Unusual Applications in Internal Grinding" at New Jersey's October meeting.

Chicago Discusses Tool and Cutter Grinding

W. A. Johnson, president of R-O Manufacturing Company, Madison Heights, Michigan, discussed "Unscientific Tool and Cutter Grinding" at the Chicago Chapter's November meeting at The Old Spinning Wheel, Hinsdale.

FOR PROSPECTIVE MEMBERS: Membership in ASA is worthwhile for every reader and for every company which receive GRINDING and FINISHING. For information about individual mmberships ($12 per year) and associate (company) memberships ($125 per year), write John Y. Arnold, Business Administrator, The American Society for Abrasives, 120 North Fifth Street, Reading, Pennsylvania.

3M Abrasives Help AMF Reduce Sheet Metal Deburring Costs

Innumerable ferrous and non-ferrous sheet metal components are manufactured for cigarette, cigar, bakery, and Automatic Pinspotter Machines at the American Machine & Foundry's Brooklyn, New York plant. Sheared to size and punched, components must then be deburred and cleaned prior to painting and plating. The previous method, using abrasive discs, often left swirl marks which had to be removed in a secondary hand sanding operation at extra cost.

As the result of a recommendation from a 3M Representative, AMF switched to the use of a wide-belt sander and "Three-M-ite" Resinbond Cloth Belts on these operations.

The results were remarkable. The new wide-belt prefinishing method eliminated all extra re-work, provided a better pre-paint surface, and cut unit costs substantially. Unit production time was slashed from more than 9 minutes to less than 30 seconds.

Why not let 3M's new COST CHECK 5-4-5 Program help you to effectively investigate ways to lower costs and increase profits. Discover . . .

- If your grinding can be done more economically
- If your finishing is as efficient as possible
- If your polishing can be done faster and better

Send today for a free COST CHECK 5-4-5 Review Form *without obligation.* Put 3M's years of abrasive know-how at your disposal.

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Use postpaid card. Circle No. 230

Informative reading in abrasive operations for management, engineering, production.

Coated Abrasive Bore Polisher

Use postpaid card. Circle No. 1

Two-page flier describes the Merit Products Company's new bore polisher, an adaptation of the flap-wheel principle to the finishing of ID's from 1" to 8". Size of the head is generally about 1" greater in diameter than that of the bore to be polished. Form BP-5. Merit Products, Inc., 3691 Lenawee Avenue, Los Angeles, California.

Cylindrical Grinders

Use postpaid card. Circle No. 2

Four-page folder briefly sketches and describes the four essentials of performance on any cylindrical grinder: work support, wheel support, wheelfeed, and wheel dressing. Landis Tool Company, Waynesboro, Pennsylvania.

Permanent Magnet Chucks

Use postpaid card. Circle No. 3

Brown & Sharpe line of permanent magnet chucks is described in four-page folder punched for standard binder. New "Micro-Mesh" chucks that can hold parts as thin as .001" for grinding are featured. Form 37A-42. Brown & Sharpe Mfg. Co., Industrial Products Division, Providence 1, Rhode Island.

Airbrasive Units

Use postpaid card. Circle No. 4

Bulletin of 16 pages explains, describes, and answers questions about the S. S. White Industrial Airbrasive® Units for cutting, deburring, and cleaning hard, brittle materials. Bulletin 6006. The S. S. White Industrial Division, 10 East 40th St., New York 16, New York.

Vibratory Barrel Finishing

Use postpaid card. Circle No. 5

Four-page folder outlines the principles and the advantages of vibratory barrel finishing, and presents examples of unusual workpieces. Three models of the Vibraslide, differing primarily in size, are pictured and described. Catalog 262. Vibraslide, Inc., 95 Prospect Avenue, Binghamton, N.Y.

Coolant Filter

Use postpaid card. Circle No. 6

Filter system for coolants and other liquids is described in two-page flier in two colors. Interesting comparisons of relative sizes and linear equivalents are included. Centri-Spray Corporation, 39001 Schoolcraft Road, Livonia, Michigan.

Double-Disc Grinding

Use postpaid card. Circle No. 7

Current issue of "Garner Grinder" highlights 4 applications of double-disc grinding: two on roller bearings, one on bathtubs, one on brake linings. Stock removal, production rates, tolerances, and other similar data are detailed. (September, 1961). Gardner Machine Company, Beloit, Wisconsin.

Unit Type Dust Collection

Use postpaid card. Circle No. 8

An economical and highly efficient unit type dust collector designed to meet a wide variety of the air volume requirements throughout industry is described in Pangborn Bulletin 916. This four-page folder explains the versatile cloth filter bag dust control equipment—how it is made, how it works, its range of use and application, its special features and details. Pangborn Corporation, Hagerstown, Maryland.

Automatic Vibratory Finishing

Use postpaid card. Circle No. 9

The new automatic Vibratron® is explained in a four-page folder. Two types are available, the batch automatic for batch production and the continuous automatic for through-feed operation. Sketches and photos supplement the text, and typical applications are included. Roto-Finish/Ransohoff, 3700 Milham Road, Kalamazoo, Michigan.

Portable Wheel Guards

Use postpaid card. Circle No. 10

Six-page folder describes the Morrison line of revolving guards for cup wheels and of attached guards for other types of portable grinding wheels. Described as "industry's most complete line" of portable wheel guards. Catalog WG. 61-1. Morrison Prod., Inc., 16816 Waterloo Road, Cleveland 10, Ohio.

Safety Recommendations for Grinding Wheel Operation

Use postpaid card. Circle No. 11

Booklet prepared by the Safety Committee of the Grinding Wheel Institute especially for the use of grinding machine operators, foremen, supervisors and others responsible for the control of grinding wheel speeds. The recommendations are the result of the collective experience of the Institute members, and are in conformance with the provisions of the ASA Safety Code

continued

(See No. 2)

(See No. 5)

(See No. 8)

(See No. 10)

LITERATURE continued

B7.1-1956. Grinding Wheel Institute, 2130 Keith Building, Cleveland 15, Ohio.

Portable Lamps

Use postpaid card. Circle No. 12

The O. C. White line of portable, adjustable bench, table and floor lamps for commerical and professional lighting is covered in a four-page, two-color folder. Magnifiers for assembly and inspection of miniature parts are included. Prices, shipping weights and specifications for all models are given. O. C. White Company, 17 Hermon Street, Worcester, Massachusetts.

Magnetic Sheet Steel Separator

Use postpaid card. Circle No. 13

Ways to increase efficiency, provide greater safety and help prevent machine breakdowns are featured in a new folder describing permanent magnetic sheet steel separators. With 29 standard models, Magni-Power separators provide efficient handling of sheets or blanks of every gauge. Magni-Power Co., Box 122, Wooster, Ohio.

Lapping Compounds

Use postpaid card. Circle No. 14

A table of grades and suggested uses for Trulap diamond abrasive lapping compound, this two-page data sheet is a chart of micron ranges, mesh equivalents and sizes of diamond powders for various applications. Data for Trulap compound includes color and number identification. Wheel Trueing Tool Co., 3200 West Davison Ave., Detroit 38, Michigan.

Rubber-Bonded Abrasive Wheels

Use postpaid card. Circle No. 15

Many uses of rubberized abrasives are included in this 22-page manual, along with actual case histories of a variety of typical applications. Also outlines most efficient methods for mounting, dressing and truing, together with recommended operating speeds. Cratex Manufacturing Company, Inc., 1600 Rollins Rd., Burlingame, California.

(See No. 16)

Ultrasonic Grinding

Use postpaid card. Circle No. 16

Ultrasonic aid for all types of industrial grinding, Cavitron "Ever-Grind," is covered in four-page, two-color brochure. It enables wheels to grind cooler and cleaner, permits the use of finer, harder wheels. Cavitron Ultrasonics, Inc., 51-02 21st Street, Long Island City, New York.

Machine Tool Rental Plan

Use postpaid card. Circle No. 17

The DoALL Company's machine tool leasing plan is outlined in a four-page folder as having five principal advantages: no capital expenditure; availability of profit-producing equipment when needed; maintenance of established lines of credit; rentals paid out of profits; and local handling of lease contract. "Greater Productivity without Capital Expenditure." The DoALL Company, Des Plaines, Illinois.

Are you being robbed by a lazy coolant?

Do you pay good money for a coolant that's supposed to do the job — yet wind up with low production, poor finishes, short wheel or tool life?

Does it tend to gum up machines or rust the work, leaving you to "take the rap?"

If so, switch to White & Bagley *lively* coolants. You don't pay for a lazy drop in a drumful!

W&B Chemical Concentrates provide unusually keen grinding action, for as little as 1/¢ per gallon of coolant.

Use **W&B 1500** for grinding steel . . . Use **W&B E-55** for grinding steel and cast iron, as well as aluminum and other nonferrous metals.

W&B Lubricant 1888 gives better finishes, tolerances, on grinding *and* cutting. High-detergent, oil-type soluble.

W&B HD Soluble Oil 2213 extends wheel or tool life on tough jobs. Heavy-duty — fine cooling action.

W&B Grinding Oil 1572 leads all other oils, in really critical thread, tap, gear, form grinding.

For Lively coolants, get in touch with: The White & Bagley Co., 88 Foster St., Worcester, Massachusetts.

W-B INDUSTRIAL LUBRICANTS

THE WHITE & BAGLEY CO.

Worcester, Massachusetts · Detroit, Michigan

Originators of Grinding Lubricants

Use postpaid card. Circle No. 232

Automatic Controls — Electrolytic Machining

Use postpaid card. Circle No. 18

In a recently-released booklet, Anocut tells what proper automatic current controls do in electrolytic machining, and how they help the average operator achieve consistently expert results. Eight-page booklet also describes Anocut's complete line of power supply units. Booklet B-1. Anocut Engineering Company, 631 West Washington Blvd., Chicago 6, Illinois.

Mounted Wheels and Points

Use postpaid card. Circle No. 19

Punched four-page folder lists and specifies the various mounted wheels and points available from Western Abrasives. Shape groups and dimensions are tabulated. Instructions for ordering are also included. Western Abrasives, 2131 S. E. Sixth Ave., Portland 14, Oregon.

Abrasive Belt Grinders

Use postpaid card. Circle No. 20

In addition to providing comprehensive data on the use of Hammond abrasive belt grinders, a new 20-page catalog contains specifications, photographs, and cutaway drawings

(See No. 20)

illustrating the construction and design features of each unit. Other grinders and polishing lathes also included. Catalog ABG-300. Hammond Machinery Builders, Inc., 1651 Douglas Avenue, Kalamazoo, Mich.

Abrasive Plate Saw

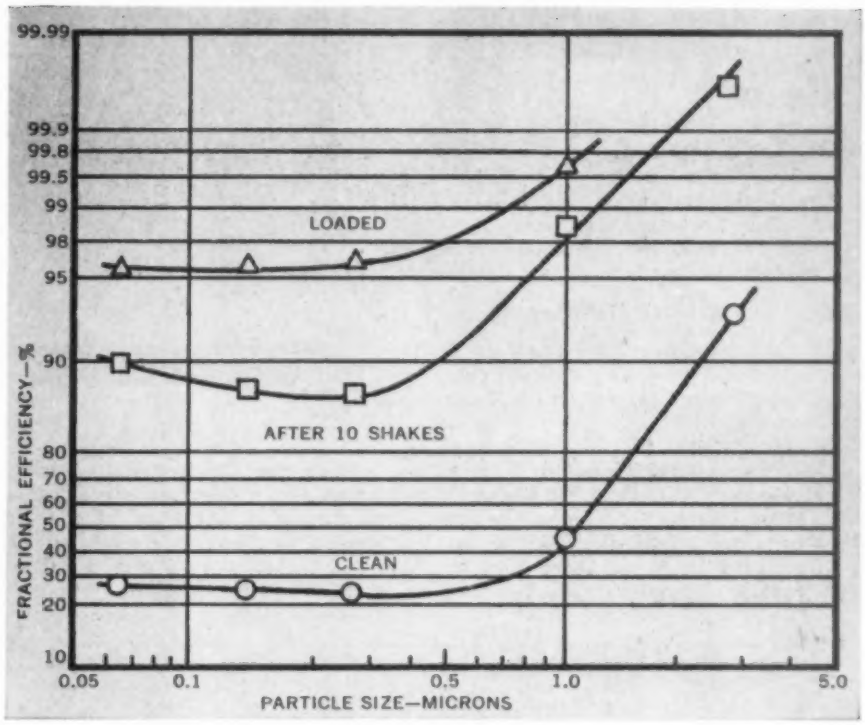
Use postpaid card. Circle No. 21

Ty-Sa-Man's Model CX dual 90° plate saw, using abrasive cut-off wheels to rip plate of any length and to cross-cut plate up to 20' in width, is described in four-page folder. Ty-Sa-Man Machine Company, Box 1269, Knoxville 1, Tennessee.

Diatomite Type Filter

Use postpaid card. Circle No. 22

Bulletin describes the fully automatic Gale "SA" Diatomite type Pre-Coat pressure filter system as "particularly suited to applications which need a unit for filtering a continuous



revolutionary "dust-making machine" proves Torit Dust Collectors have

HIGH AIR FILTERING EFFICIENCY

Because of an increase in critical dust collection problems and rising standards in industrial hygiene, need has arisen for more precise measurements of filtering efficiency. In the past, because of inability to produce uniform-size, sub-micron dust particles, filtering efficiency has been measured by weight. However, recently a homogeneous aerosol generator capable of producing uniform sub-micron particles as fine as .05 microns (1/500,000 inch) and as coarse as 15.0 microns, has been developed by Dr. K. T. Whitby, leading authority on particle technology. (Smoke, fumes, and bacteria fall within this range; most industrial dusts are 2 microns or larger.) Tests using such uniform particles indicate fractional efficiency based on particle count . . . the most exacting filter efficiency tests ever devised.

Under this most demanding of all filter tests, Torit Cloth Filter Dust Collectors performed superbly. Fractional efficiency when loaded with fine dust ranged from 96% at 0.1 micron to 99.99% at 2.5 microns; and after shaking 10 times, from 88% at 0.1 microns to 99.93% at 2.5 microns.

For further information, write for Dr. K. T. Whitby's Technical Report on the "Fractional Efficiency Characteristics of a Torit Unit Type Cloth Collector."

TORIT manufacturing company

1133 Rankin Street, St. Paul 16, Minnesota, Dept. 536

Use postpaid card. Circle No. 233

flow of any volume required." Detailed coverage, with suggested specs for filter installation. Bulletin 9030-A. Gale Separator Company, Division of Infilco, Inc., P. O. Box 5033, Tucson, Arizona.

Abrasive Cut-Off Machines

Use postpaid card. Circle No. 23

Specification sheets and descriptions cover two "Speed-Cut" abrasive cut-off machines. No. 11 is a 4 hp economy model with a capacity for 3" shapes and 1½" solids. No. 20 is a 20 hp unit which will handle most 6" shapes and up to 4" x 4" solids. Typical cutting times for various shapes and solids in differing materials are listed. Abrasive Machine Division, Beaver Pipe Tools, Inc., Dana Avenue, Warren, Ohio.

The NEW NO 11
"Speed Cut" Abrasive Cut-off Machine
NOW . . . YOU CAN ENJOY THE ADVANTAGES OF ABRASIVE CUTTING
Priced So Low You Can't Afford To Be Without It!
ABRASIVE MACHINE DIV., BEAVER PIPE TOOLS, Inc.

(See No. 23)

Contract Flat Lapping

Use postpaid card. Circle No. 24

Production flat lapping, or flat machining, services and advantages are outlined in four-page bulletin from Abrading Systems, described as "the largest contract lap-grinding shop in the country." Abrading Systems Co., 3638 W. Oakton St., Skokie, Illinois

(See No. 24)

Chop-Stroke Abrasive Cut-Off

Use postpaid card. Circle No. 25

Thirty horsepower manually operated abrasive cut-off machine, the Ty-Sa-Man "Chop Saw Chop," is detailed in four-page folder. Machine will handle up to 8" x 8" sections or solids, cuts at a rate of less than three seconds per square inch. Ty-Sa-Man Machine Company, Box 1269, Knoxville 1, Tennessee.

Cutter Sharpening Accessories

Use postpaid card. Circle No. 26

Rocheleau attachments and accessories for cutter sharpening are described in a new 24-page catalog. Featured is an improved cutter grinding fixture and air-cushioned spindle bearing. Catalog 604. Rocheleau Tool and Die Co., Inc., Leominster, Massachusetts.

Self-Contained Dust Collectors

Use postpaid card. Circle No. 27

Self-contained air pollution control equipment developed for the control and collection of industrial dusts in metalworking and other operations is outlined in 4-page folder. Feature of equipment is its "building block" construction. Bulletin No. 230. John Wood Company, Air Pollution Control Division, Florham Park, N. J.

Mist Coolant Systems

Use postpaid card. Circle No. 28

A giant-sized mist coolant system, for use on heavy-duty grinding operations where standard mist spray units do not have sufficient cooling capacity, is described in a couple of pages. Lloyd Tool Corporation, Box 4007 (1222 N. Fair Oaks Ave.,) Pasadena, California.

Tool Grinding and Finishing

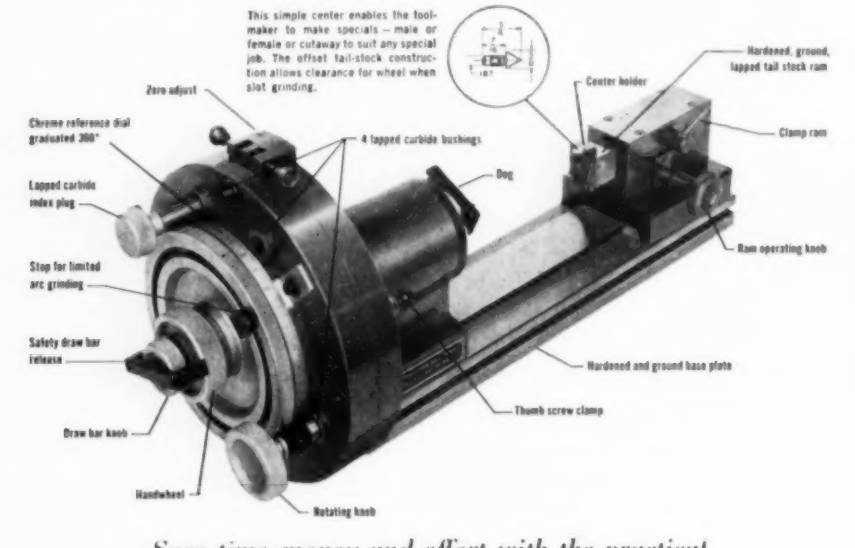
Use postpaid card. Circle No. 29

A series of panels across the inside of a four-page folder highlight the salient features of the Leonard Grind-r-lap, a bench model tool grinder. Precision tool finishing on the unit, according to the folder, does not require skilled operators. Leonard Precision Products Co., Grind-r-lap Division, 9200 Bolsa Avenue, Santa Ana, California.

Mist Coolants

Use postpaid card. Circle No. 30

An analysis and list of advantages of using mist style coolant systems, which can significantly increase grinding wheel and tool life, is available on request. Ash & Co., 5100 Grand River, Detroit 8, Michigan.


This simple center enables the toolmaker to make specials – male or female or cutaway to suit any special job. The offset tail-stock construction allows clearance for wheel when slot grinding.
Zero adjust
Chrome reference dial graduated 360°
Lapped carbide index plug
Stop for limited arc grinding
Safety draw bar release
Draw bar knob
Handwheel
Rotating knob
4 lapped carbide bushings
Dog
Center holder
Hardened, ground, lapped tail stock ram
Clamp ram
Ram operating knob
Hardened and ground base plate
Thumb screw clamp

Save time, money and effort with the practical

MOORE PRECISION INDEX CENTER

The versatile Moore Index Center is a handy precision tool with tolerances that compare to the reputable Moore Measuring Machine. It is an instrument that will improve the facilities of any toolroom, or precision parts maker, when applied to:

1. Inspection of work on centers.
2. Jig boring, milling, and jig grinding work on centers.
3. Form grinding—spiders, splined punches, gear die punches and dies, sectional parts of dies where revolving the part on centers or in a spindle is necessary.

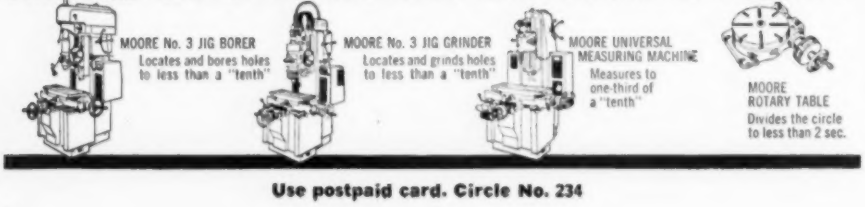
To give you an idea of how it achieves peak precision, and gets its work done quickly, examine the following Moore Index Center's special features:

1. Special ball construction spindle; lapped-fit, 192 balls with ±.000005" (5 millionths) tolerance under load. Runs true to .000015" (15 millionths) T.I.R.
2. Lapped Carbide Index Plug and 4 lapped-fit carbide Plug-in-Stations, 0°, 45°, 90°, 180°* 24-hole hardened and jig ground index plate accuracy of spacing ±5 sec.
3. Accurately adjustable tail stock. Center line-up is maintained with lapped-fit ram movement of center.
4. Headstock uses "Moore Shank."
5. Sealed against dirt, it can also be used in wet grinding.

**Extra plug-in-station allows the user to turn his workpiece exactly 180° at any time to get his cut on dead center. It can also be used to re-orient for a different set of angles on the same workpiece.*

Write today for illustrated folder giving details, including specifications—
Moore Special Tool Co., Inc., 725 Union Avenue, Bridgeport 7, Connecticut

ONLY MOORE TOOLS CAN OFFER THIS COMPLETE PACKAGE OF PRECISION


MOORE No. 3 JIG BORER
Locates and bores holes to less than a "tenth"
MOORE No. 3 JIG GRINDER
Locates and grinds holes to less than a "tenth"
MOORE UNIVERSAL MEASURING MACHINE
Measures to one-third of a "tenth"
MOORE ROTARY TABLE
Divides the circle to less than 2 sec.

Use postpaid card. Circle No. 234

Book Reviews

SHAPES AND SIZES OF DIAMOND GRINDING WHEELS

(An American Standard, B74.3—1961, sponsored and published by the Grinding Wheel Institute. 40 pages.)

"American Standard Specifications for Shapes and Sizes of Diamond Grinding Wheels, Hand Hones and Mounted Wheels," to give the publication its full title, does for diamond wheels essentially the same service as the Standard Shapes brochure does for grinding wheels of aluminum oxide and silicon carbide.

Standard shapes for diamond wheels were established in 1957 with the publication of the first Standard in this series. That publication systematized a series of designations that had grown up haphazardly and had become both unwieldy and inadequate.

The present publication, expanded from the original 16 pages to 40, adds standard sizes for each shape based on sound engineering and industry demand. These should satisfy the vast majority of industry's needs, according to the foreword.

A second major addition is the material on hand hones and mounted wheels.

An appendix comparing the current shape designations with the ones outmoded by the 1957 publication has been continued.

Grinding Wheel Institute, Dept. GF-12, 2130 Keith Building, Cleveland 15, Ohio.

SHOP GUIDE FOR APPRENTICE TRAINING

(Released by the National Tool, Die & Precision Machine Association, $2.50)

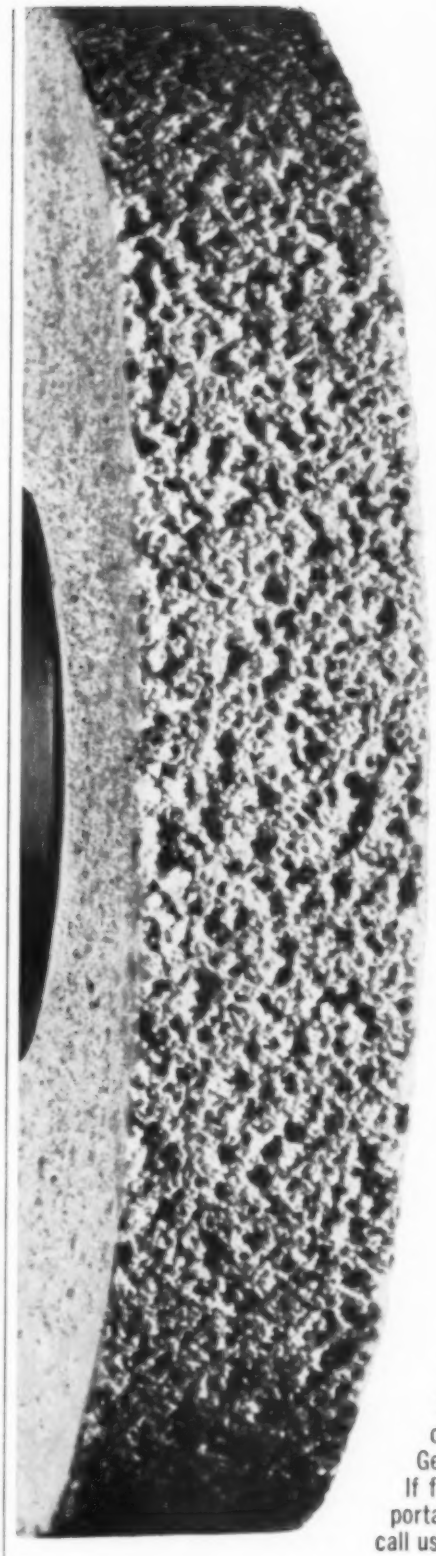
Here is a convenient illustrated checklist for the instructor as he goes through the various phases of each machine and toolroom process with the apprentice. It covers the essential machine functions and machining operations required in the average toolroom.

Let's assume that the apprentice is being trained on grinders, either as an introduction to the machine or in advanced work. The instructor, of course, knows the subject thoroughly. But to train the apprentice properly, he must remember to cover a long list of points and, later, a series of questions on which to test the apprentice's knowledge.

"The Shop Guide" saves the instructor extensive memory work. He merely turns to the pages on which a certain machine is featured, in this case a grinder, and goes right down the line, discussing types, their operation, workholding devices, speeds and feeds, attachments and accessories, safety factors, and care of the machine.

Detailed photographs of every piece of equipment covered in the book, with their complete nomenclature, are included.

The Book Shelf, Dept. GF-12, Hitchcock Publishing Co., Wheaton, Ill.



5 BIG REASONS

why you should use FM surface grinding wheels on your HILL-ACME MATTISON THOMPSON horizontal spindle surface grinding machines

1. RA Abrasive — new, fast-cutting aluminum oxide. 2. V6 Bond — a tough, durable vitrified bond. 3. Durabush Bushing — wheels mount easily — run truer; spindles last longer. 4. Quick delivery — stock or special orders. 5. Prompt, Expert Field Service

SIZES: 20" x 3" and 20" x 6" — with 8, 10, or 12 inch holes

General Purpose Specification: RA36-I8V6

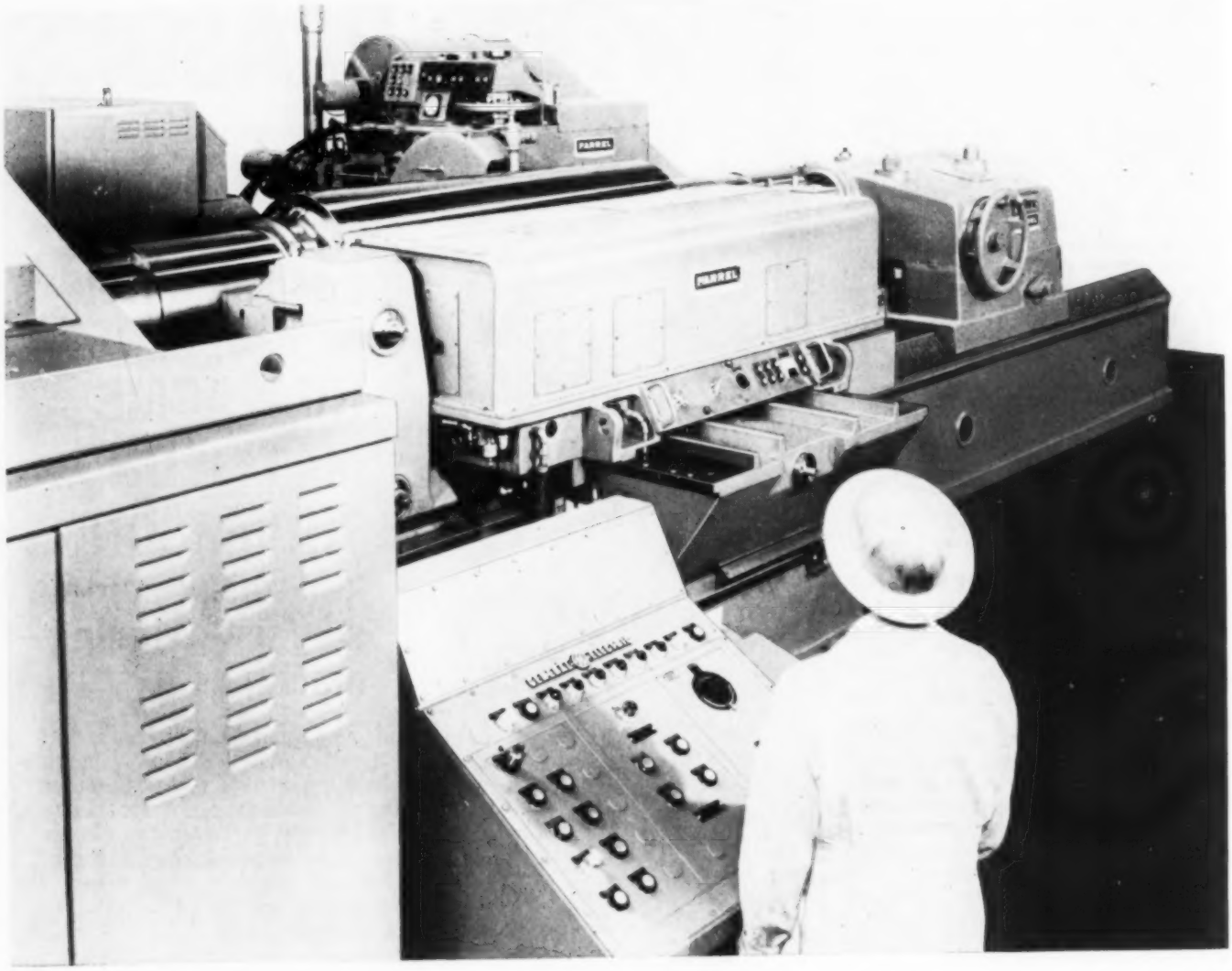
If fast, cool, precision surface grinding is important to you — call your FM supplier today. Or call us direct!

THE FM VITRIFIED AND RESINOID WHEELS AND SEGMENTS!

FULLER MERRIAM CO. 72 Water St. West Haven, Conn. Telephone WEst 3-2501

Use postpaid card. Circle No. 235

HEAVY-DUTY ROLL GRINDER WITH NUMERICAL CONTROL



Complete automation of a 60" heavy-duty roll grinder under punched-tape control by the Farrel-Birmingham Company and General Electric has produced a machine that will automatically grind straight or crowned rolls up to 5' in diameter to exacting tolerances of diameter and straightness. It will also duplicate diameters for pairs of work or backup rolls.

The machine's ability to produce extreme repeatable accuracies permits mill management to fix and maintain definite standards of regrind procedures. Longer roll life also results, since stock removal is automatically held to a minimum in the regrind operation.

The roll grinder control uses servo-controlled positioning of probes to measure the diameter and profile of rolls being worked, and to detect work remaining to be done.

Operating from standard 1" tape, the automatic control directs the grinder through a complete refinishing cycle. Once the operator starts the grinding wheel and pushes the "cycle start" button, the machine takes over and completes the cycle from aligning and rough grinding the workpiece to finish grinding and measuring and recording a printout of roll size.

The controls may select any of ten speeds for the machine headstock, carriage, grinding wheel, step infeeds, and continuous infeed rates. For wheel dressing, any of six combinations of diamond positioning and crossfeed may be selected.

Special features in the automatic control will match the diameters of both work rolls in a mill-stand pair, irrespective of original diameter or uneven wear. This is essential in modern metal rolling.

Automation of the roll grinder was made possible by a unique wheel infeed system and by the addition of a probe table opposite the grinding wheel carriage.

Through the sophisticated control, servo-positioned hardened steel probes scan each new roll to find the point of greatest wear and automatically set this as a "bench-mark" for the rough grinding operation and determination of finished diameter.

Similarly, the control memorizes the finished diameter of the first roll and matches the finished diameter of the mating roll to it automatically. This check is made positive by the probes against the actual work surface rather than measurement of the position of the grinding wheel.

Another advanced feature of the automatic system is made possible by the special "trunnion-tilt fine infeed" arrangement used by Farrel-Birmingham to mount and control the grinding wheel.

With the General Electric control, this feature is used both to step the wheel forward into the work with extreme accuracy and to continuously infeed the wheel to compensate for wheel wear. Any of ten rates may be programmed for each of these functions.

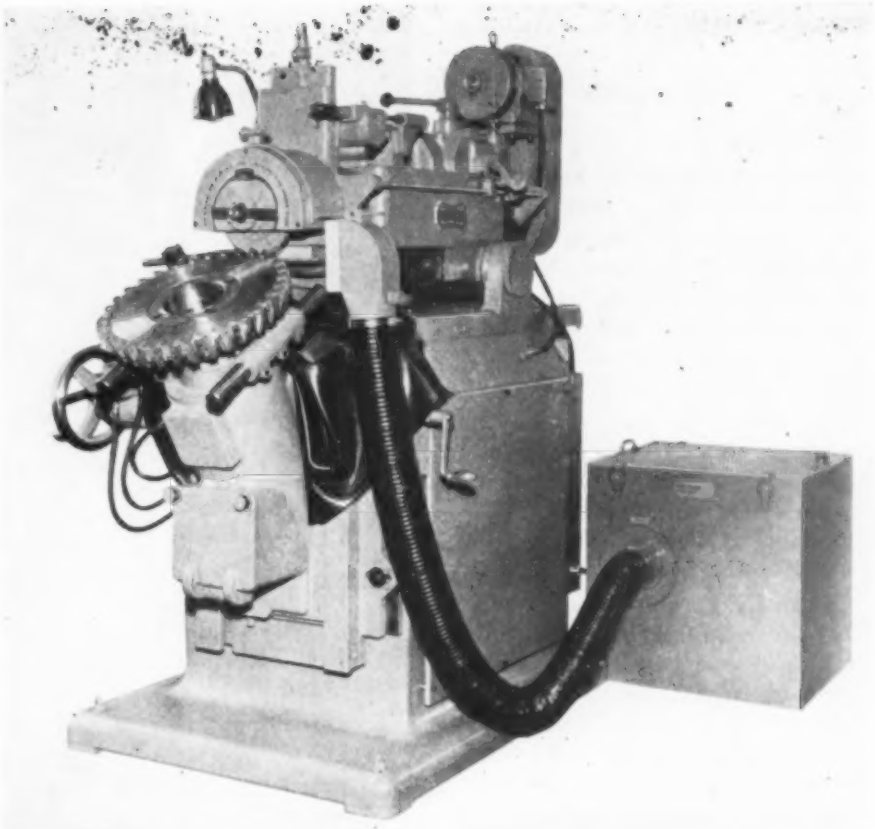
Since mill rolls normally show greatest wear in their center portions, the probe table finds the minimum diameter here. To reduce the higher end surfaces of the roll to this diameter, the control first orders a special sequence known as "short stroking."

After initial familiarization it is expected that the automated roll grinder will materially speed up roll grinding operations.

Assuming proper mill setup, better matched rolls will produce more uniform strip from the rolling mill and will increase service life of each pair of rolls between re-grindings.

Thus, the mill operator will simultaneously reduce operating expense and increase yield from his mill.

Farrel-Birmingham Company, Inc., Ansonia, Connecticut.



STANDARD DUST UNIT USED "AS IS" ON GRINDERS

A standard Aget dust collection unit has been "job-matched" to an Oliver face mill grinder without requiring the slightest adaptation or special installation techniques, according to Maurice Olsaver, Aget sales manager.

The installation was made with a standard Model 520 Dustkop, which can be attached as illustrated or can be mounted directly above the the grinder. This will permit the hood to change from one side of the wheel to the other, as required.

This Dustkop unit can also be used on surface grinders, universal grinders, drill grinders, saw grinders and on numerous offhand type grinders using up to two 6" diameter wheels or one 10" wheel.

Aget Manufacturing Company, Adrian, Michigan.

CLEANER REMOVES IMPACTED BUFFING COMPOUNDS

A new emulsion cleaner has been designed to remove had impacted buffing compounds from all types of basic metals. Called Metex Emulsion Cleaner M-624, it may be used in concentrations as low as 5%.

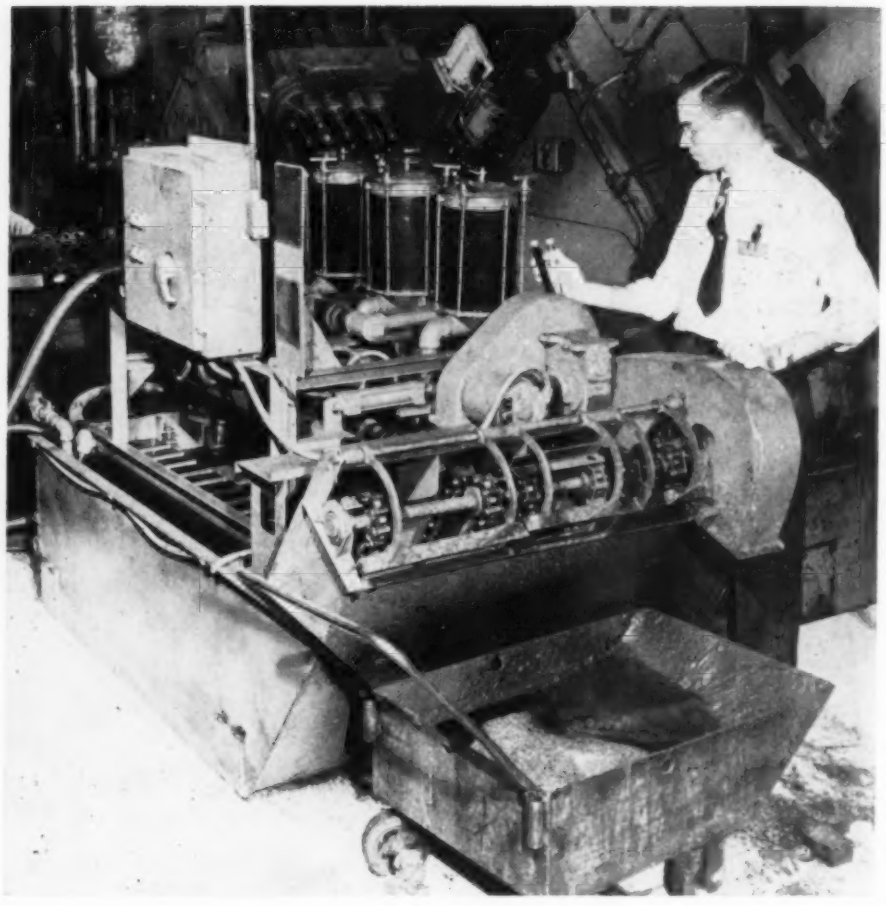
MacDermid Incorporated, Waterbury 20, Connecticut.

TYPE 28 HAT WHEEL NEEDS NO SPECIAL ADAPTER KIT

A Type 28 (hat) wheel recently brought out by Geo. H. Bullard Co. employs a bonded-on $\frac{5}{8}$-11 hub which eliminates the need for special adapter kits or assemblies. The complete wheel is designed with three layers of reinforcing fibre glass.

Designed especially for maximum effectiveness of high-speed air-driven or electric portable grinders that operate at 5200 rpm or more, the wheels are available in 7¼" and 9¼" diameters. Production quantities are available and sizes may be combined.

Geo. H. Bullard Co., Inc., Westboro, Massachusetts.



COMBINATION UNIT FILTERS TO 5 MICRONS AT 500 GPM

A combination separator and back-flushing cartridge filter, for use during gun drilling, honing and lapping operations will filter to 5 microns, in capacities of 20 to 500 gpm.

The dirty coolant enters the separator and by retarded movement through overflow weirs, most of the solids are separated before the liquid is pumped through the cartridges for filtering.

By time clock and electronic control, one cartridge is back-flushed for 6 to 10 seconds using the filtered liquid from other cartridges. Cartridges are back-flushed in sequence as required to maintain the desired flow rate.

The back-flushed liquid containing the dirt flows into a conveyorized seeper tank, from which it slowly flows through small holes to a settling tank where it is held 8 to 20 hours, or until solids are settled. The liquid then overflows to pump section for re-circulation. Conveyors in all sections remove solids to tote box.

Pleated paper cartridges, for use with oil, water or other soluble-type coolants, are made in 5, 20 and 40 micron retention sizes. Pleats are uniformly spaced and reinforced with nylon band to provide strength for back-flush pressure and to keep pleats apart during filter cycle.

Henry Manufacturing Co., Inc., 519 E. Reed Street, Bowling Green, Ohio.

Use postpaid card. Circle No. 45

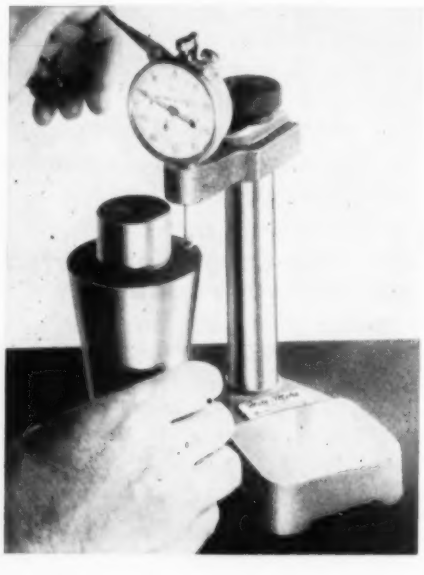
INTRODUCE ECONOMY LINE OF HEIGHT INSTRUMENTS

"Hite-Mikes" furnished with a one-inch micrometer head, a one-inch dial indicator, or a half-inch dial indicator are available for establishing and transferring heights, for measuring size and for checking size.

Units consist of a 1.000" high base with chrome plated and lapped top surface (approx. seven square inches) and three lapped pads on the underside. A six-inch high column holds five one-inch tubular stainless steel gage blocks.

Micrometer head, or dial indicators are held in a 1.000" thick yoke which has chrome plated and lapped slides. The yoke can be inserted over any block on the column and may be positioned through 360 degrees. Yoke slides are two inches long to permit optimum clearance for work and tool.

"Hite-Mikes" with one-inch micrometer head may be used for setting heights from zero to 5 inches, using the tool base as the working surface and from zero to 6 inches using a surface plate as the zero point.



A second "Hite-Mike" model is equipped with a one-inch dial indicator mounted in the yoke with graduations in .001" and readings from 0 to 100. Indicator has a lift mechanism and a count hand.

All models are set quickly at the desired height by loosening a knurled clamp nut at the top of the column, sliding the yoke over the gage block nearest the required height and tightening the clamp nut.

Brown & Sharpe Mfg. Co., Industrial Products Division, Providence 1, Rhode Island.

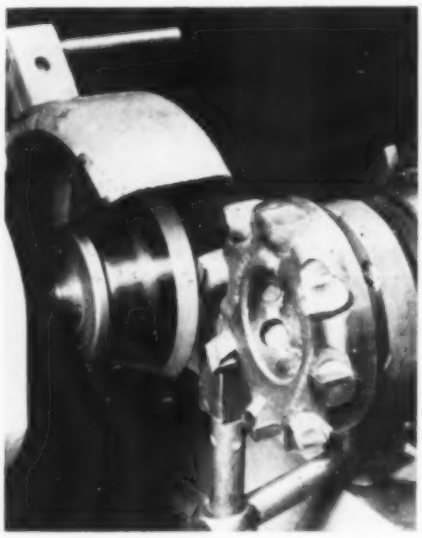
Use postpaid card. Circle No. 46

DIAMOND WHEEL RESINOID BOND GRINDS WET OR DRY

Reports of a six-month field testing program indicate that Norton Company's new B-56 resinoid bond for diamond wheels performs more efficiently on both wet and dry grinding than earlier bonds designed for either type of operation.

Increased wheel life over previous wheels of up to 30% were fre-

quently noted in test reports. In a few cases, wheel life was doubled. Finish and free cutting were maintained while the grinding ratio increased (i.e. more carbide was removed per unit of wheel wear).

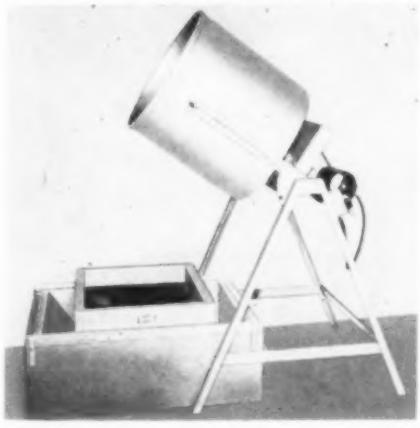


Norton wheels made with the new bond are available in all sizes and shapes. In general, the new bond does not require a change in wheel specification for doing the same operation as former wheels. Although the new bond provides greater productivity and the versatility of one wheel for both wet and dry grinding, prices of B-56 bonded Norton diamond wheels are the same as wheels made with other resinoid bonds.

Norton Company, Worcester 6, Massachusetts.

Use postpaid card. Circle No. 47

COMPACT TUMBLING UNIT DRIES, DEBURRS, CLEANS



A new compact tumbling machine, the Gravi-i-Flo Model PD-10 can be used for cob meal or sawdust

continued

Olson automatic Magnetic Separator... Builds profits 6 ways

1. **Saves coolant** by automatically removing ferrous metal particles. Coolant can then be recirculated for reuse.
2. **Longer Wheel and Tool Life** because you operate with clean wheels and tools. There's less loading—less wheel dressing.
3. **Guarantees Finer Finishes—Fewer rejects** as scratch-causing abrasive particles are removed from coolant.
4. **Cuts Maintenance Costs.** Automatic removal of sludge reduces downtime for machine cleaning.
5. **Increases Production** because of fewer rejects, less downtime, better working conditions.
6. **Fast Return on Investment** due to longer coolant life, longer wheel and tool life, less maintenance and increased production.

For complete information on the new Olson Automatic Magnetic Separator call your nearby Olson distributor or mail the coupon.

Olson Filtration Engineers, Cincinnati 12, Ohio OL-21

Send information on Olson Automatic Magnetic Separator.

Name _____

Firm Name _____

Address _____

City _____ Zone ____ State _____

OLSON FILTRATION ENGINEERS

5024 Section Avenue, Cincinnati 12, Ohio

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drying of metal parts, as well as deburring and burnishing, or cleaning operations. Weighing about 160 lbs., the machine has a cylinder capacity of 6 cubic feet and is furnished with either 1/3 or 1/2 hp motor drives.

Priced under $400.00 the Gravi-i-Flow PD-10 is of fabricated steel construction with a simple lock pin mechanism allowing three tilting positions, load, unload, and running. Although the cylinder is furnished unlined as standard equipment, neoprene lined cylinders are available.

A separating bin, generally used to separate sawdust or cob meal from metal parts, is available with the unit. The bin size is 14½" high x 38" wide x 41" long.

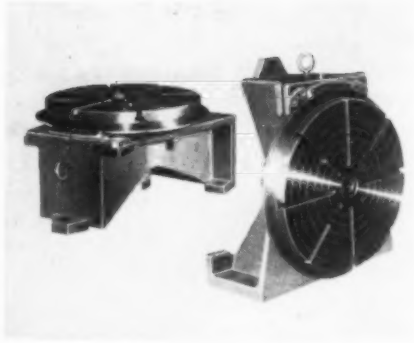
Grav-i-Flo Corporation, Sturgis, Michigan.

Use postpaid card. Circle No. 48

UNIVERSAL ROTARY ANGLE

A new combination rotary table and angle plate can be used either horizontally or vertically for a wide variety of inspection, layout and machining applications.

The free-wheeling face plate rotates 360° with a radial accuracy, by vernier, to 5 minutes visual reading. And for convenient readings in either horizontal or vertical position, graduations are on a 45° angle.



Over-all table diameter—18".

Table flatness and runout to .0002". Positioning rings and eight T-slots provided to facilitate loading and clamping parts. Two-point table lock assures positive locking. Optional extra: precision centering plug and sine bar arrangement for Jo block positioning.

Machine Products Corporation, 6771 E. McNichols Road, Detroit 12, Michigan.

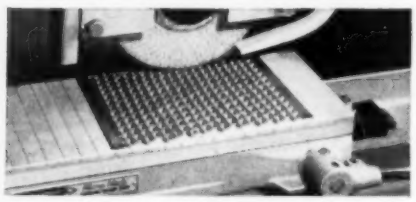
Use postpaid card. Circle No. 49

53-pound grip on 1/32" thin strip...

B&S chuck demonstrates holding power sufficient for 8 hp grinding machine load — by supporting its own weight on 1" x 1/32" steel strip.

New Brown & Sharpe Micro-Mesh Chuck

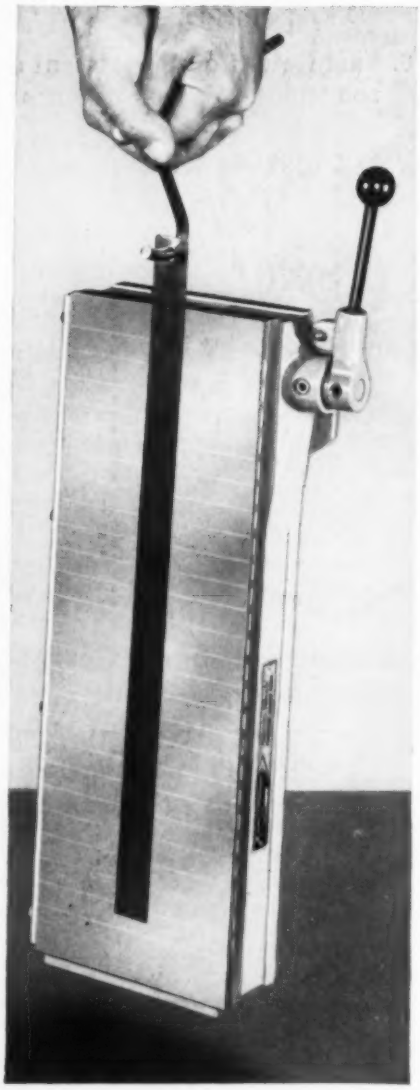
holds parts as thin as .001" for grinding!



Make big savings, grinding or machining small parts. Use the *only* magnetic chuck that grips work as thin as .001", tight enough for production cuts.

Close-spaced, barium-ferrite (ceramic-type) permanent magnets — no dead spots or weak zones — powerful, unbroken field, over the entire working surface.

Ask your B&S distributor for new Micro-Mesh Chucks! Brown & Sharpe Mfg. Co., Prov. 1, R. I.



Brown & Sharpe PRECISION CENTER

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ORBITAL FINISHING MACHINE HAS RE-CIRCULATING WASH

Cleaner work, faster cutting action and longer life for tumbling media result from the re-circulating wash system of the Rampe Vi-Brader precision finishing machine.

The machine provides continuous washing action on both media and parts during deburring, radius forming or polishing operations. Wastes are removed, compounds remain undiluted, and the processed parts do

not require a separate cleaning cycle.

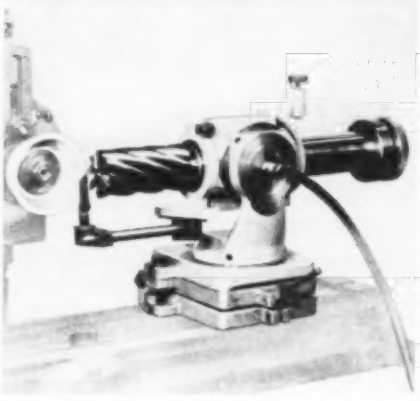
The re-circulation system maintains a regulated flow of water into the processing tub, removing the waste water through a screened drain opening at the bottom.

The Vi-Brader machine rotates the load in a circular controlled orbit. It has variable speed control, choice of conventional barrels or tubs, and full 1¼ cu. ft. capacity. Accessory controls and equipment is also available.

Rampe Manufacturing Co., 14915 Woodworth Ave., Cleveland 10, O.

Use postpaid card. Circle No. 50

IMPROVE AIR-CUSHION SPINDLE BEARING



An improved air-cushioned spindle bearing is now standard equipment for the Rocheleau universal cutter grinding unit 1-B. Units 1 or 1-A currently in use may be converted to air cushion operation with the new bearing.

The air-cushioned spindle bearing reduces friction by eliminating metal-to-metal contact and produces a smooth, effortless grinding motion which results in longer tool life, smoother finished surfaces, and increased spindle speeds.

Rocheleau Tool and Die Co., Inc., Leominster, Massachusetts.

Use postpaid card. Circle No. 51

HAVE ± .00005" ACCURACY FOR TOTAL RANGE

Two new precision dial indicators have an A.G.D. accuracy of ± .0005" for the .15" range (2½ turns). No. 25-109 is a balanced dial indicator which a range of 0-3-0, one revolution .006", total range .015". No. 25-209 is a continuous dial model, reading 0-6, one revolution, .006" total range .015". Both indicators are furnished with jeweled bearings.

L. S. Starrett Co., Athol, Mass.

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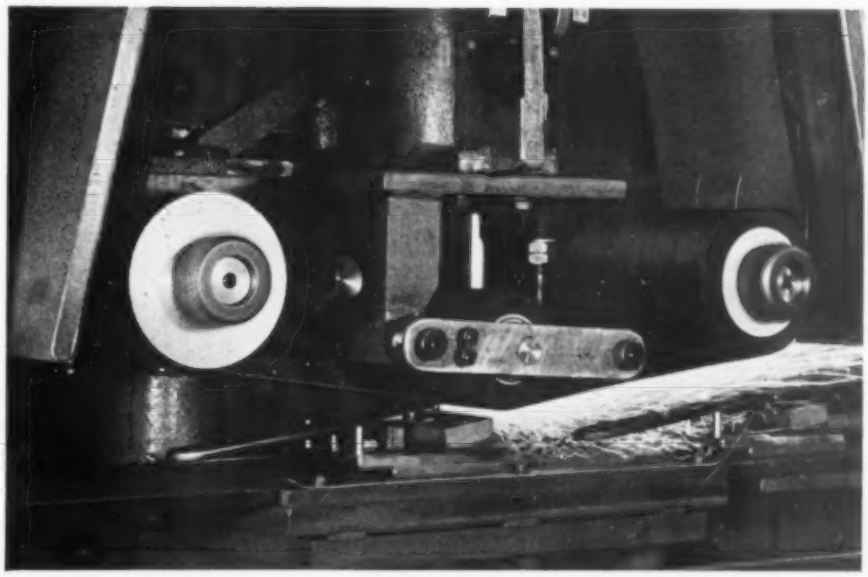
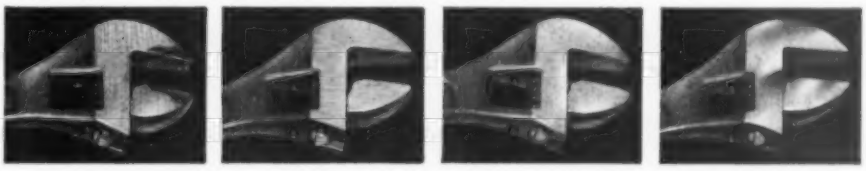
ACME IN ACTION



Progressive Finishing—Flat broached forgings ground, polished and buffed on an Acme Automatic Multiple-Head Machine.



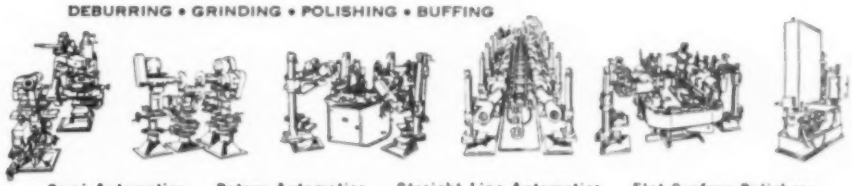
Doing more work with
Movement and Motion

Designing and building versatile finishing machines that do more work—better, faster, easier, and at lower cost—is a specialty at Acme. Has been, too, for over half a century.

Take the multiple-head flat surface finishing machine shown close-up in action above. It consists of standard Acme components, yet it can be used to perform a number of operations on a wide variety of parts. Deburr, grind, polish—buff or satin finish. All done automatically—in a single pass if desired. What's more, oscillating movement of the conveyor in motion prolongs useful life of abrasive belts and buffing wheels—assures greater uniformity of finish on every piece.

Range of models? Light and heavy duty machines—conveyor belt or pinch roll fed—available in sizes to accommodate your flat parts and products up to 74 inches in width!

DEBURRING • GRINDING • POLISHING • BUFFING



Semi-Automatics Rotary Automatics Straight Line Automatics Flat Surface Polishers

Comprehensive catalogs available upon request. Write, wire or call:

ACME MANUFACTURING COMPANY

1400 E. 9 Mile Road • Detroit 20 (Ferndale), Michigan • JOrdan 6-1550

Leading Producers of Automatic Polishing, Buffing and Deburring Machines Since 1910

Use postpaid card. Circle No. 241

DIAMOND ABRASIVE COMPOUND

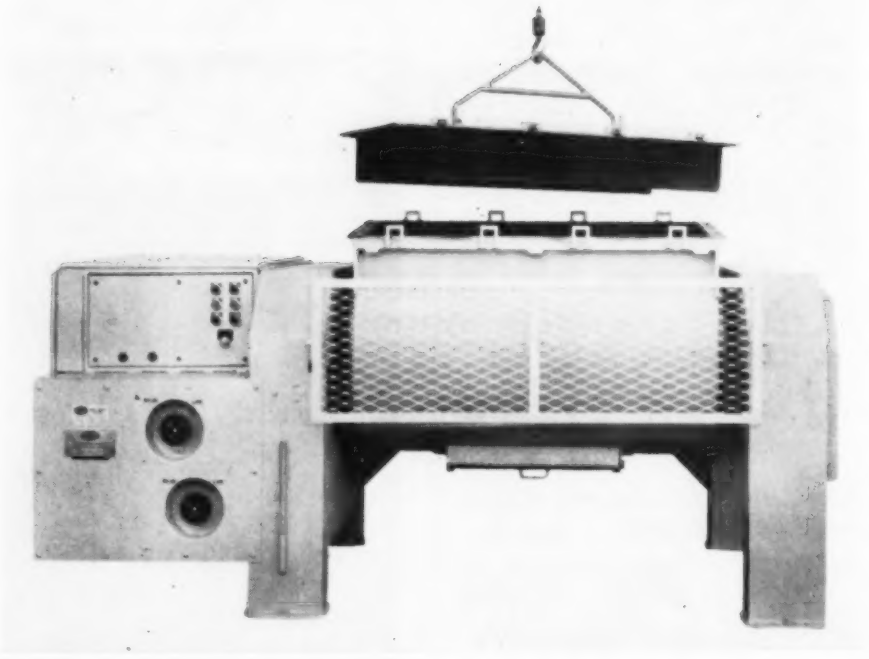
Outstanding feature of the diamond abrasive compound introduced by Blue Streak Diamond Co. is that particle size is closely controlled. The vehicle is a homogeneous formula with a maximum of sharp cutting edges; it is also completely water soluble.

Compounds are available in standard micron and mesh sizes. They are uniform and positively identified by color and number. Each is ready to use; no stirring, mixing, special tools or skills are required.

As a special introductory offer, a "Kolor Keyed" diamond abrasive compound board is included with every purchase of four five-gram jars of the compound.

Blue Streak Diamond Co., Inc., 36855 Schoolcraft Road, Livonia, Michigan.

Use postpaid card. Circle No. 53



UNIT COMBINES ROTARY, VIBRATION FINISHING

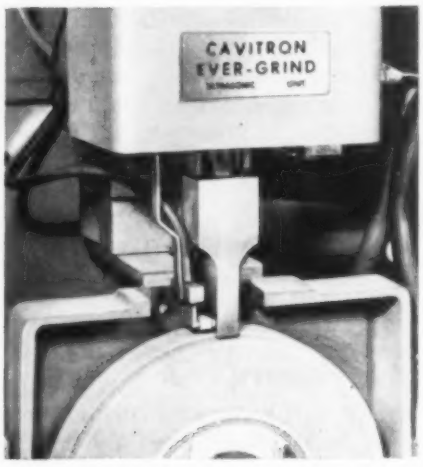
A combination of vibratory and rotating barrel finishing is a feature of a 20 cu. ft. capacity unit built by B. W. McIntyre Company, Reseda, California, and to be distributed by 3-M's Honite Division.

The top cover is so designed that when it is in place, the cylinder can be rotated as a barrel, with or without vibration. With the cover off the unit can be operated as an open-tub vibrator.

The 1962 Model VBT Combination barrel and tub vibrator is available also in larger capacity units built to order. Three smaller models will be introduced shortly.

Minnesota Mining & Mfg. Co. (Honite Division), 900 Bush Avenue, St. Paul 6, Minnesota.

Use postpaid card. Circle No. 54



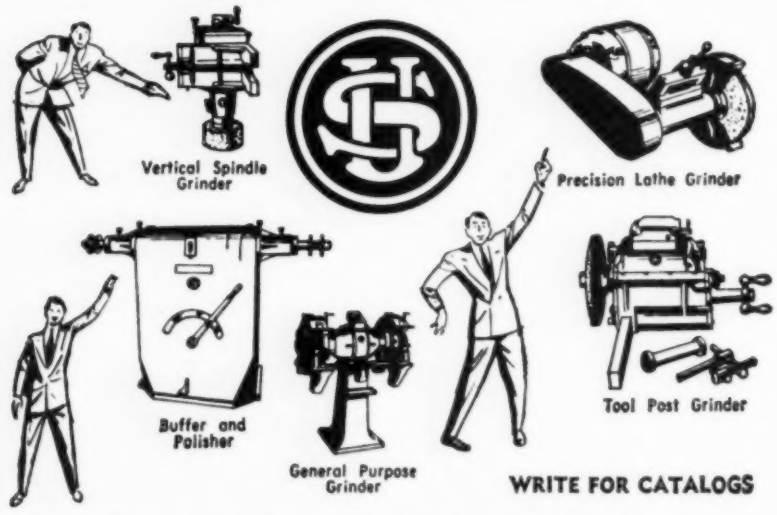
ULTRASONIC UNIT PREVENTS GRINDING WHEEL LOADING

A revolutionary new ultrasonic unit, designed to improve the performance and life of any grinding wheel far beyond what was previously possible, is now being produced by the Cavitron Engineering Corporation.

GRINDERS

BUFFERS

Now when quality performance and money-saving are of utmost importance—when cost-minded executives demand exacting vigilance, these tools fulfill every requirement.



WRITE FOR CATALOGS

Over 60 YEARS of Service to Industry

The United States Electrical Tool Co.

3640 LLEWELLYN ST., CINCINNATI 23, OHIO

Use postpaid card. Circle No. 242

Known as the Cavitron Ever-Grind, this new device speeds up production by reducing excessive loading on the wheel, thus cutting the need for frequent dressing and downtime.

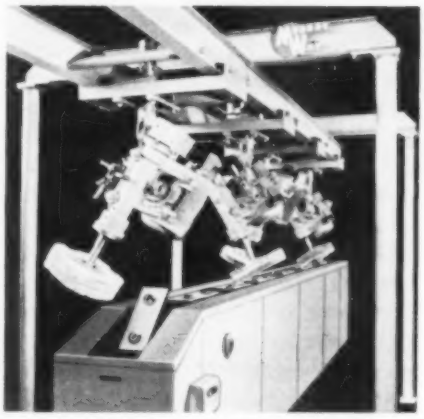
The Ever-Grind uses a magnetostrictive transducer, driven by a generator operating on 60 cycle line current and converting it to vibrate the transducer at the rate of 20,000 cycles a second. An aluminum tool, attached to the end of the transducer, is positioned close to the grinding surface of the wheel.

As coolant is passed through the tool and on to the surface wheel, thousands of bursting bubbles (cavitation) are induced within the agitated fluid and "explode" against the grinding wheel as it rotates, simultaneously blasting away any build-up of metal particles and cooling the wheel. This highly effective cleaning and cooling technique can provide both increased grinding production and more efficient, economical, and higher quality grinding on an extensive range of materials.

Cavitron Equipment Corp., 51-02 21st Street, Long Island City 1, N.Y.

Use postpaid card. Circle No. 55

OVERHEAD BUFFING HEAD USES LESS WORK SPACE



Full wheel contact with irregular work shapes, where a combination camber in two planes is involved, may now be achieved with fewer heads and a smaller work space requirement using Murray-Way's No. 052 overhead-mounted full universal buffing and polishing heads.

The overhead-mount feature of these new heads effects a great saving in floor space. They may be placed much closer together than floor-mounted heads which require clearance for adjustments by the operator. Easy access is afforded to both conveyor and heads, and clean-up is greatly simplified.

Where conventional heads employ one fulcrum which allows the work wheel to rise and fall with the contour of the work piece in only one plane, the Murray-Way No. 052 head utilizes two fulcrums, affording a more flexible, universal-type movement of the work wheel, enabling it to follow closely an irregular shape in two planes simultaneously. Two simple fulcrum adjustments determine the degree of angularity and accurately position the wheel.

The No. 052 head has a capacity up to 20 hp. The wheel spindle incorporates heavy-duty, anti-friction bearings which require no grease or oil and are sealed against dirt for cool, trouble-free performance. The automatic motor mounting adjustment keeps proper tension on the drive belt at all times, and a spindle lock makes wheel replacement simple and convenient.

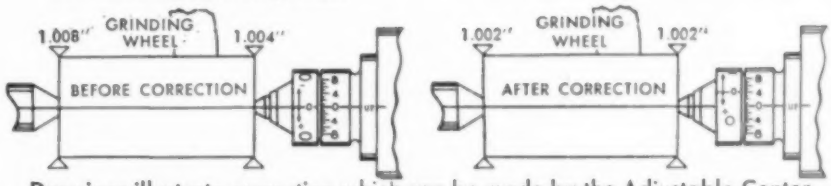
Murray-Way Corporation, P. O. Box 180, Birmingham, Michigan.

Use postpaid card. Circle No. 56

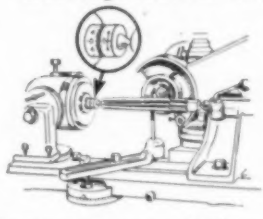
NEW . . . fast, easy CENTER ALIGNMENT for GRINDERS

Center being used on grinder

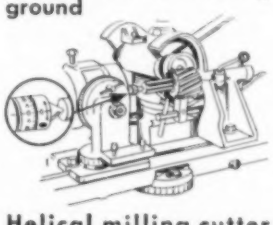
The Erco Micro-Set® Adjustable Center



Drawings illustrate correction which can be made by the Adjustable Center



Taper reamer being ground



Helical milling cutter being reground

- Permits TRUE work alignment from tailstock or headstock on: cylindrical grinders, cutter grinders, gear shavers, lathes and tracer attachments.
- Saves one half the setup time.
- Ends hit or miss table adjustments to obtain precise alignment.
- An inexperienced operator can get a precise alignment—easily—in seconds.
- Quickly pays for itself in time and scrap savings.

MORSE TAPER
No. 2—$49.50, No. 3—$61.50, No. 4—$76.00.

BROWN & SHARPE
No. 6, 7—$53.00, No. 8, 9—$65.00, No. 10, 11—$85.00.

JARNO
No. 6, 7—$53.00, No. 8, 9—$65.00, No. 10, 11, 12—$85.00.

STRAIGHT SHANK
¾"—$56.00, 1"—$68.00, 1¼", 1½"—$80.00.

We also manufacture Precision Lathe Turrets and Tiny Titan Magnet Base Holders.

Erco MANUFACTURING CO. Dept. 8121 4520 W. Fullerton Ave., Chicago 39, Ill.

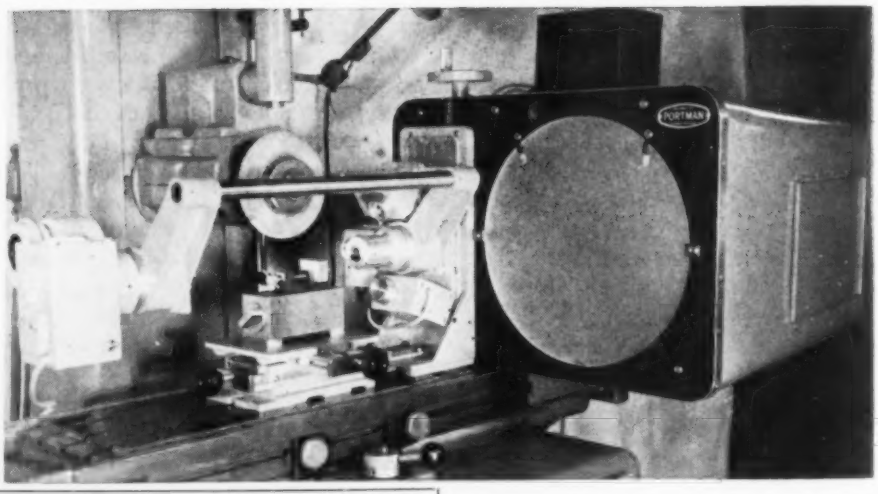
Write for catalog and nearest distributor.

Use postpaid card. Circle No. 243

OPTICAL FORM COMPARATOR FITS SURFACE GRINDERS

A new optical form grinder projector comparator, the OFG-300, may be used on most standard surface grinding machines.

Operation is extremely simple. Conventional grinder controls are used to develop shapes and forms by following the enlarged projection of the workpiece on the screen.



The projector is bolted to the "T" slots on the grinder table and can easily be removed. The unit can then be used as a conventional comparator on a work bench.

The projector is furnished complete with a focusing work table, surface illumination attachment, graduated screen, and lens magnifications of 10X and 20X.

Portman Instrument Company, 1997 Palmer Avenue, Larchmont, New York.

Use postpaid card. Circle No. 57

INTRODUCE BUDGET-PRICED ULTRASONIC WHEEL CLEANER

The diSONtegrator System 320, a five-gallon capacity ultrasonic cleaner for renewing cut-off wheels, grinders and abrasive wheels of all types, features a broad band frequency modulated circuit which eliminates the need for automatic tuning as found in much higher priced equipment. The generator is rated at 320 watts average power—1,280 watts peak power output. Fused for 10 amps, the generator operates from 117 volt-50/60 cycle line current. A 220 volt-50/60 cycle export model is available at a slight additional cost.

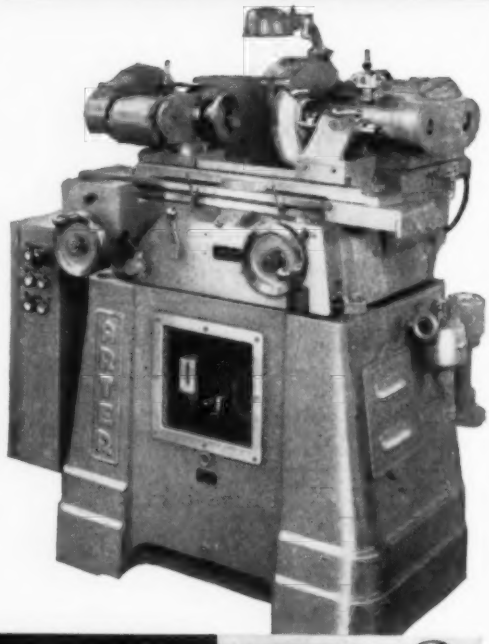
The five-gallon capacity cleaning tank features a working compartment measuring 14" long x 10" wide x 10" deep.

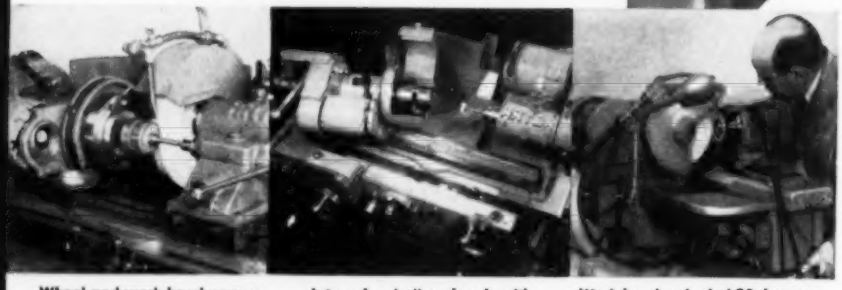
Operation is as simple as that of a radio; the generator is plugged into any convenient source of 117 volt-50/60 cycle current and consumes no more current than a light bulb. Cleaning begins as soon as the tank is filled with a suitable cleaning solution such as water and detergent or solvent and the switch is flipped on.

Best buy for toolroom or small-capacity production grinding

The Sundstrand-Arter Model 103 can be arranged for cylindrical or internal grinding. Wheel heads swivel 15 degrees either side of center — work head swivels 90 degrees. It's ideal for toolroom or production work where a small-capacity machine is needed, or for supplementing larger grinders when work piles up. Multiple-jaw chucks, faceplates, and other chucking accessories can be quickly attached to spindle nose.

Sundstrand-built to highest precision standards, this moderately priced grinder has a complete hydraulic movement of table and wheel head. Maximum capacities: external—3" OD, internal—3" ID.





Wheel and work head arranged to grind cylindrical work.

Internal grinding head with work head swiveled.

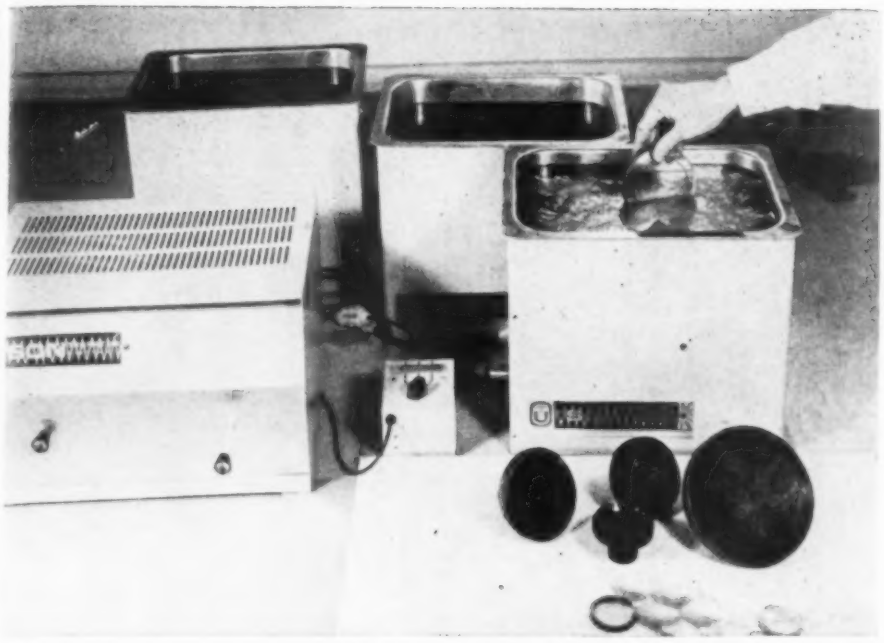
Work head swiveled 90 degrees to grind a gear shaper cutter.

For complete information, write for Bulletin 918.

MARK OF RELY-ABILITY

SUNDSTRAND ARTER

SUNDSTRAND MACHINE TOOL
BELVIDERE, ILLINOIS
Division of SUNDSTRAND CORPORATION
Use postpaid card. Circle No. 244



CIRCULAR LIGHT MAGNIFIER AIDS VISUAL INSPECTION

A circular light magnifier, Nikon's model 2, is an aid in visual inspection, assembly, and testing.

The unit has a high quality optical glass lens which gives 3 diopter, distortion-free magnification. With an auxiliary lens, magnification is 5 diopters.

It has two fluorescent ring lights which can be used individually or in combination. A gimbal mount permits multi-position adjustments. The 10½" x 8¼" unbreakable plastic light panel, the working platform, has an opal tint for uniform, glare-free illumination.

Nikon, Inc., Instrument Division, 111 Fifth Avenue, New York 3, N.Y.

Use postpaid card. Circle No. 60

The low price of U.I. diSONtegrators will now enable any economy minded grinding or finishing facility to take full advantage of ultrasonic cleaning—the fastest, highest quality method of soil disintegration ever devised.

U.I. diSONtegrators are backed by a free five-year, no charge for labor service contract and a two-year, no charge for parts guarantee, the most complete coverage available anywhere.

Ultrasonic Industries, Ames Court, Engineers Hill, Plainview, L.I., N.Y.

Use postpaid card. Circle No. 58

HEAVY-DUTY CUT-OFF PARTS MOST METALS

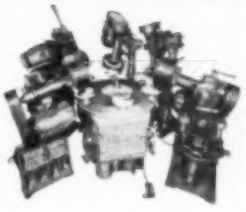
Stone Machinery Company's Model M-160 is a heavy-duty, high-speed, metal cut-off machine designed for a wide variety of ferrous and non-ferrous applications.

Model M-160 is powered by a full 15 hp continuous duty, geared-in-head TEFC ball bearing induction type motor, 220/60/3 or 440/60/3, with load ammeter, overheating indicators, and No. 2 magnetic starter. The geared-in-head feature is a Stone exclusive, designed to produce greatest efficiency of power from motor to spindle.

Available in either 20" or 24" size, with stationary type wheel guard for maximum operator safety, the M-160 may be equipped for wet or dry cutting, as well as manual, semi-automatic or automatic operation.

Stone Machinery Co., Manlius, New York.

Use postpaid card. Circle No. 59



Hammond Automatic Deburring Machines will increase production, assure a uniform finish, reduce operator fatigue and save floor space.

Send sample parts for complete engineering report.

Hammond Machinery Builders INC.

1651 DOUGLAS AVE. KALAMAZOO, MICH.

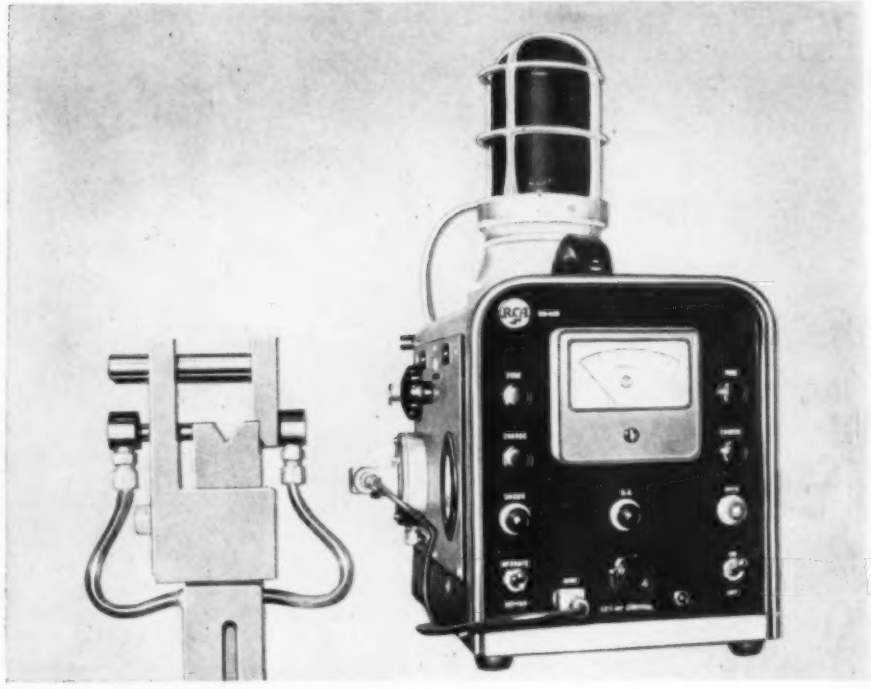
Use postpaid card. Circle No. 245

AUTOMATIC POST-PROCESS GAGE FOR CENTERLESS

This low cost gage consists of an RCA limit signaling comparator, which operates on air-electronic principles, and a gaging station fixture with twin air jets on a "v" block which is mounted to the end of the centerless grinder rest blade.

Parts leaving the grinder enter the fixture and pass between the opposing air jets. The increase or reduction of the air flow caused by part-diameter variations is translated into a signal that actuates a meter and signal lights. The large warning light on top of the unit and the upper and lower limit lights on the front panel of the comparator warn the operator that parts out of preset tolerances are being produced. A green light on front of unit flashes as acceptable parts are gaged.

Since limits can be set well within the allowable tolerances, the operator is alerted and can make grinder corrections before actual rejects are produced. A time delay switch is also incorporated in this unit to prevent spurious signals which would be caused by gaps between parts coming off the grinder. The comparator itself can be located on top of the grinder or on some other nearby support.



Radio Corporation of America, Industrial and Automation Division, 12605 Arnold Avenue, Detroit 39, Michigan.

Use postpaid card. Circle No. 61

STANDARD MODELS

For Custom Dust Collection

A full range of job-tailored, standard DUSTKOPS — to serve single or multiple machine installations — is ready to answer your individual collection problem. Whether you're engaged in manufacturing, processing, converting or packaging, if air-borne particles are a factor, Aget has the answer — *your* answer.

DUSTKOPS are easier to install, save space, save money and are virtually trouble-free. Write for your copy of our free brochure to help you select the proper unit for your needs. No obligation, of course.

Also a complete line of mist collectors.

AGET MANUFACTURING COMPANY
1380 Church St., Adrian, Michigan

Use postpaid card. Circle No. 246

COMPACT SWING FRAME GRINDER

The *Compact* Swing Frame model has been added to the well-known Marschke line. Powered with a 5 H.P., 3600 RPM motor to drive Resinoid wheels at 9500 S.F.P.M., this grinder gives ample power for rapid stock removal; is suspended in perfect balance for ease in handling; has a convenient handle arrangement; reduces operator fatigue to a minimum. Designed for fast and efficient grinding. The spindle will accommodate grinding wheels 7″ dia. or 10″ dia. by 1″ face width by 1″ bore. Write for details on all grinding or finishing problems.

Grinding and Polishing Machinery Corp.
SUCCESSORS TO VONNEGUT MOULDER CORPORATION
2530-B WINTHROP, INDIANAPOLIS 5, INDIANA

Use postpaid card. Circle No. 247

GE METALLURGICAL OPENS DIAMOND APPLICATION LAB

GE METALLURGICAL OPENS DIAMOND APPLICATION LAB

A new diamond application development laboratory facility has been put into operation by the Metallurgical Products Department of General Electric Company, according to an announcement from J. D. Kennedy, general manager, diamond products section.

The new facility has been set up to investigate new and improved diamond applications, to evaluate new GE man-made diamond types and to analyze comparative performance testing operations, according to Kennedy.

The laboratory is equipped with a variety of standard grinding machines having special modifications to permit accurate control of the many variables which affect diamond performance. Among numerous investigative projects currently under way at the laboratory are: (1) evaluation of GE man-made diamond grinding hardened steels, (2) determination of the feasibility of using diamond in plate glass grinding, and (3) evaluation of the performance of manufactured diamond in blades for masonry cutting applications.

Manager of the new facility is E. L. Kapernaros.

Section of new GE application laboratory, showing grinding machines modified to permit accurate control of variables affecting diamond performance.

BUCKEYE TOOLS TOIL AT NEW DELHI FAIR

Twenty Buckeye air tools have completed an 11,000 mile trip from Dayton, Ohio, to the golden domes of the U.S. exhibit at the Indian Industries Trade Fair in New Delhi.

The fair, which opened Nov. 14 and runs for seven weeks, coincides with the start of India's third "five year" plan for industrial development. Wall panels and narration will explain how the exhibited devices can best be used to spur India's industrial growth.

All are "working" displays, with a full factory complement of Indian workers running the equipment and machinery.

The fair is expected to attract over 3,000,000 visitors. The American exhibit will occupy a five acre site, and its three main buildings will be enhanced by 32 giant precast concrete golden domes.

Sheffield Board Chairman, Louis Polk (L) is awarded the American Standards Association's 1961 Howard Coonley Medal by John R. Townsend, ASA President at the annual awards luncheon, October 11th, at Houston, Texas.

STANDARDS ASSOCIATION HONORS LOUIS POLK

Louis Polk, board chairman of The Sheffield Corporation and director and vice president of the Bendix Corporation was awarded the American Standards Association Howard Coonley Medal for 1961 on October 11th at the 12th National Conference on Standards, Houston, Texas.

The award is in recognition of Polk's almost three decades of leadership in establishing high standards for dimensional quality control and for "the service he has rendered to the advancement of standardization and the understanding of its significant role in the American economy."

COMPANY PLANS TO IMPORT EMERY FROM NAXOS

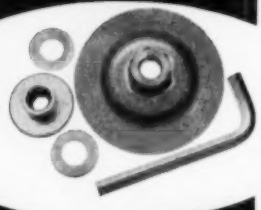
A new, major source for abrasives used throughout industry, natural emery (aluminum oxide) processed into corundum, has been announced by The Corundum Co. of Pasadena, California. It is used for polishing wheels and belts, pressure blasting,

continued

SAFETY BACKS

STRAIGHT AND FLARED CUPS

SAFETY FIRST



LOW COST ADAPTOR KIT

The new low cost Carroll Adaptor Kit made of cold forged steel offers outstanding features not found in other designs costing several times more. Strong — Wear Resistant — Rust Resistant — High Quality.

Also designers of:

• Carroll Safety Backs • Throw-A-Way Hubs • Track Grinding Wheel Safety Backs • Heavy Duty Disc Wheel Inserts

Write for further information

CARROLL PRESSED METAL, INC.

PM INC 133 DEWEY ST. WORCESTER 10, MASS.

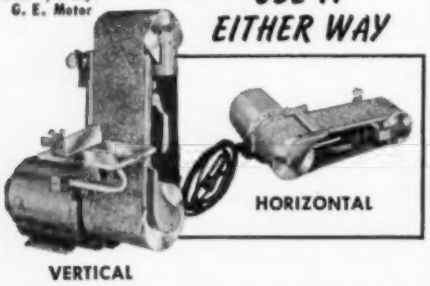
SPECIALISTS IN ALL TYPES OF GRINDING WHEEL METAL INSERTS

Use postpaid card. Circle No. 250

WALLS TU-WAY BELT SANDER

Full 1/3 h.p. G. E. Motor

USE IT EITHER WAY



HORIZONTAL

VERTICAL

At last, a top quality industrial sander that provides all the most wanted features — yet sells for so little.

complete with cord, plug, switch ready to use $89.95

Work table in vert. illus. optional.

Illustrated Literature on Request

A few desirable distributor territories still available.

WALLS SALES CORPORATION

59-63 Van Dam St. Brooklyn 22, N. Y.

Use postpaid card. Circle No. 251

INDUSTRY NEWS continued

tumbling, grinding wheels, sharpening hones and stones, bonded abrasives, etc. It comes in standard screened grit sizes, graded according to the size specifications published by the U. S. Department of Commerce National Bureau of Standards.

In its natural state, emery is found in only three areas—Russia, South Africa, and Naxos, Greece. Emery formerly was imported into the United States in large quantities.

The Corundum Co., composed of substantial American industrialists, now has exclusive export concessions from the Greek Government for all Naxos emery.

OSBORN MFG. CO. CONFIRMS NEW TYPE GRINDING WHEEL

The Osborn Manufacturing Company, Cleveland, Ohio, has confirmed rumors of a completely new type of grinding wheel.

The result of two years of intensive research, development, and field testing, the new wheel is reported to rough and finish in one operation. It is also said to be extremely safe in operation.

CAVITRON MERGES SUBSIDIARY

At a recent meeting of the Board of Directors of The Cavitron Corporation, chairman Frederick I. Schuster announced the merger, effective immediately, of the corporation and its wholly-owned subsidiary, Cavitron Equipment Corporation. Name of the new company is Cavitron Ultrasonics, Inc.

ENCO OFFERS SPECIFIC PRODUCT GUARANTEES

Enco Manufacturing Company, Chicago builder of lathe turrets, adjustable centers and magnetic base tools, is now offering a one year guarantee on all its products. In addition to the general statement which guarantees Enco products to be free from defects in materials and workmanship for one year from date of purchase, the company makes specific guarantees on each of its products.

They are:

(1) All turret tool posts to have re-indexing accuracy to .0005".

(2) Tailstock turrets to have ± .0001" shank to hole alignment.

(3) Self-indexing hex turrets to re-index machine ± .005".

(4) Micro-Set adjustable centers to be accurate in the .006" tip movement range to ±.0002".

Mr. Antoine Rougier (right) president director general, and Mr. Jacques Allix, assistant, of Etablissements G. Durrschmidt, Lyons, France, recently visited Bay State Abrasive Products Co. In picture, Arthur E. Gilman, president, is discussing "Koolie Hat," one of Bay State's latest abrasive products. The Durrschmidt Company is one of Europe's largest grinding wheel manufacturers.

AIR GRINDER CLEANS NUCLEAR WELDS

Close-quarters welding encountered in shipboard work on reactor piping is duplicated at school for qualification to make nuclear plant pipe welds at New York Shipbuilding Corporation, Camden, N.J. Work is deliberately placed near corner and under headroom restriction. Welder must learn to make satisfactory welds under these conditions.

For grinding between passes when making "Grade A Clean" welds, New York Ship uses Wilson Model 913-41 remote-exhaust pneumatic grinders made by Thomas C. Wilson, Inc. Exhaust via a tube concentric with air supply hose minimizes contamination of weld area by grinder lubricant.

Note exhaust tube end visible near filter-lubricator stand in foreground. Also important in confined space is muffler effect of the remote exhaust tool.

AMERICAN GAGE AFFILIATES PURCHASE COMPANIES

Two affiliates of American Gage & Machine Company, Chicago, have purchased additional companies, according to a recent announcement.

The Bellwood Manufacturing Company has acquired the Snow Manufacturing Company, builder of high-speed automatic tapping and drilling machines with automatic fixturing. Herman Goldberg, president and former owner, remains as president, will be mainly concerned with research activities.

Tom Owen, formerly head of the thread gage and tap division of Size Control, another AG&M affiliate, will operate Snow as executive vice president.

Laminated Metals has bought the Improved Seamless Wire Co., Providence, Rhode Island, a specialist in bonding precious metals to base metals.

Vincent W. Makin will operate the company as executive vice president, with Chester F. Buckley as president, and Herbert Phillips as vice president, sales and marketing.

CRAFTS BUILDS NEW PLANT

Arthur A. Crafts Co., tool and gage manufacturers and distributors, announces the construction of a new plant in the Waltham Research and Development Park on Route 128 in Waltham, Massachusetts.

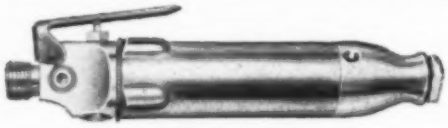
According to Roger H. Huston, president, the new facility covering 40,000 square feet will provide better service to its customers through more efficient plant layout, enlarged stock storage space and modern shipping room.

The company's general offices and New England sales division will also be located in the new plant.

M-B

CYCLONE

PNEUMATIC GRINDER



MODEL 60

Power to Spare—Easy Handling

Light Weight—15 Oz.

SPEED 50,000 R.P.M. . . . OVERALL LENGTH 6½". This husky little grinder, when used with Carbide Burs, Rotary Files and Mounted Wheels, produces astonishing results on real production work. It continues to do so with the minimum of time out of service. AIR CONTROL LEVER for starting and stopping flexible and efficient. ADJUSTING SCREW regulates speed for varying air pressure. BEARINGS special greased. Spindle accommodates mandrels ¼" dia. A collet ¼" O.D. ⅛" or 3/16" I.D. available for use in spindle.

WRITE FOR LITERATURE

M·B PRODUCTS
46 VICTOR AVE., Div. 13
DETROIT 3, MICHIGAN

Use postpaid card. Circle No. 253

$895

BUYS NEW

"Compact"

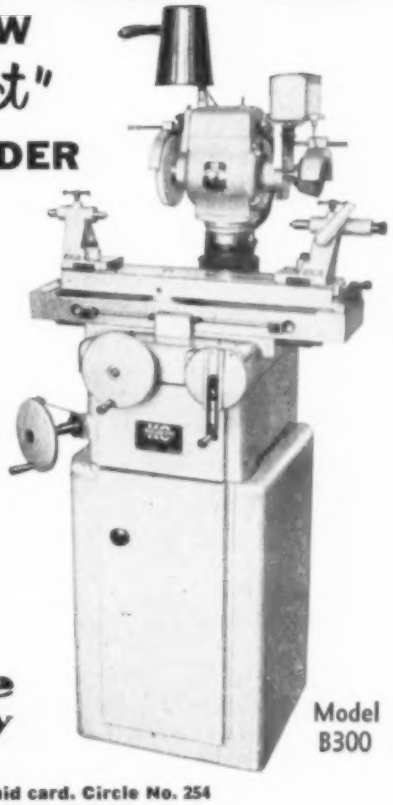
TOOL GRINDER

This precision engineered grinder is guaranteed to do anything that machines costing two or three times more will do.

Its compactness makes it easier to work on, easier to change set-ups, easier to hold accuracy, easier to turn out more work. It will take work up to 17½" long between centers with 8¼" swing that can be easily increased to 10¼" with 1" raising blocks. Table Traverse 10". Cross Feed 5".

This fine machine has the necessary capacity to handle all the tool and cutter grinding in the average shop.

Available with Universal Grinding Spindle Head, speeds 3450 to 20,700 R.P.M. at additional price.



Model B300

K.O. Lee Company
ABERDEEN, S. D.

Use postpaid card. Circle No. 254

Changing Faces . . .

SAGINAW BEARING COMPANY

The board of directors of Saginaw Bearing Company has elected M. C. Patterson as president and treasurer.

Patterson, former Dodge Division general manager and Chrysler Corporation vice president, succeeds William Agricola, who will retire February 1, 1962.

M. C. Patterson

WHEEL TRUEING TOOL CO.

Donald J. Wallace, vice president-manufacturing, Wheel Trueing Tool Co., Detroit, has been advanced to vice president-sales for the Detroit Tool Sales Division.

Arthur J. Baehr, Cleveland representative, joins Wallace as sales manager. James E. Slanaker, former Detroit sales engineer, succeeds Baehr in Cleveland.

Donald J. Wallace

E. W. Bell

A & C ENGINEERING CO.

Appointment of E. W. Bell as general manager of A & C Engineering Co., Warren, Michigan, has been announced by George L. Atherholt, Sr., vice president.

WILTON TOOL MANUFACTURING CO.

Albert J. Furman has been appointed manager of manufacturing for the Wilton Tool Manufacturing Company, Schiller Park, Illinois.

Theodore S. Strojny

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BAY STATE ABRASIVE PRODUCTS CO.

Theodore S. Strojny has been promoted to manager of Bay State's newest subsidiary, Bay State Abrasives S/A, Luxemburg.

ELECTRO REFRACTORIES & ABRASIVES CORP.

George J. Guindon has been named Mid-West regional sales manager of Electro Refractories & Abrasives Corporation, Buffalo, N.Y. His headquarters will be in the Chicago area.

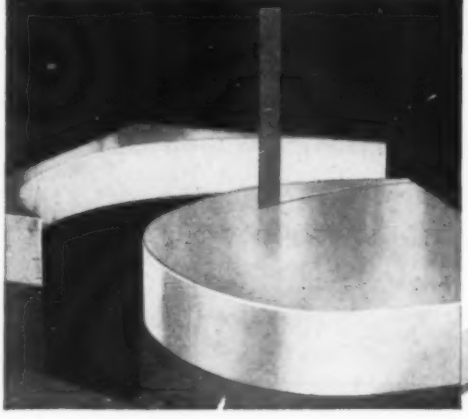
BAUSCH & LOMB

Three new departments have been established by Bausch & Lomb, Inc., Rochester, N.Y.: the Industrial Sales Department, headed by Robert L. Grau; Laboratory Sales Department, headed by David J. Joerger; and Analytical and Photogrammetric Sales Department, headed by James F. Starks. Each will report to Herbert J. Mossien, sales manager, Instrument Division.

Dr. Leo S. Packer has been appointed manager, Military Products Division, reporting to the vice president in charge of manufacturing and operations.

William A. Kerr, who has headed this division since it was established two years ago, has been elected president of Bausch & Lomb's subsidiary, Applied Research Laboratories, Inc., succeeding Dr. Maurice F. Hasler, one of the founders of ARL, who has been elected Chairman of its board of directors.

Diamond Coated Band Saw Blades



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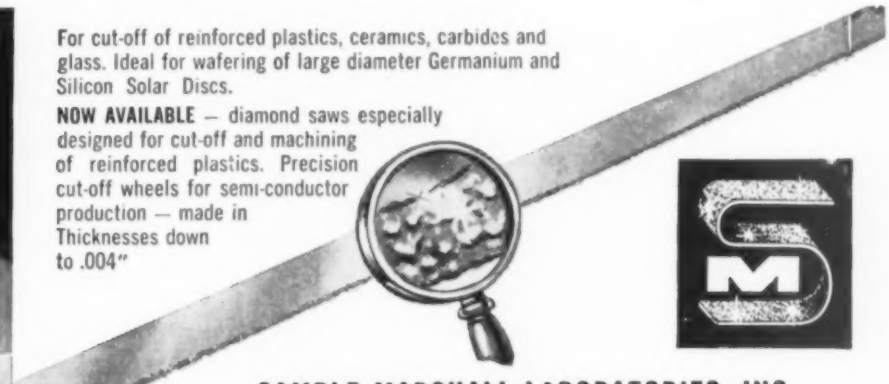

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Grinding and Finishing

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The Fourth Annual STATE OF THE INDUSTRY
Leading machine tool builders and abrasive manufacturers look back at 1961, forward to 1962, to highlight what has happened and to provide an informed forecast as to what is coming.

Centerless Grinding, Part III
Grinding and regulating wheels, wheel dressing and truing, coolants.

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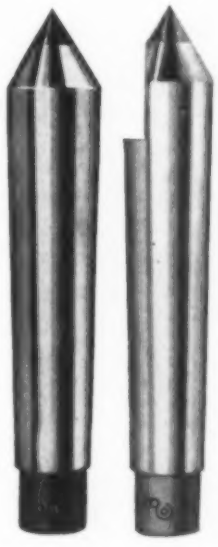

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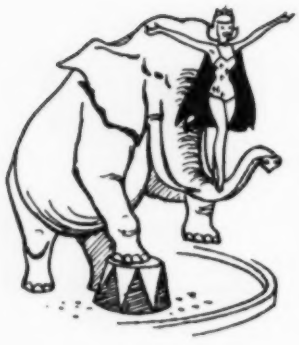

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A CHRISTMAS STORY

This season recalls to mind an incident which happened several years ago. Our company mailed a Christmas greeting with the title "One Solitary Life." While familiar to millions, it is worth repeating:

Here is a young man who was born in an obscure village, the child of a peasant woman. He grew up in another village. He worked in a carpenter shop until he was thirty, and then for three years he was an itinerant preacher. He never wrote a book. He never held an office. He never owned a home. He never had a family. He never went to a college. He never put his foot inside a big city. He never traveled 200 miles from the place where he was born. He never did one of the things that usually accompany greatness. He had no credentials but himself.

While he was still a young man, the tide of public opinion turned against him. His friends ran away. He was turned over to his enemies. He went through the mockery of a trial. He was nailed to a cross between two thieves. While he was dying, his executioners gambled for the only piece of property he had on earth, and that was his coat.

When he was dead, he was laid in a borrowed grave through the pity of a friend.

Nineteen centuries wide have come and gone, and today he is the central figure of the human race and the leader of the column of progress.

I am far within the mark when I say that all the armies that ever marched, and all the navies that ever sailed, and all the parliaments that ever sat, and all the kings that ever reigned, put together, have not affected the life of man upon this earth as has that

"ONE SOLITARY LIFE."

Editors, writers and ministers have attributed the above anonymous tribute to many sources including Phillips Brooks, O. Henry, Mark Twain and others. It has appeared in many anthologies and has been the subject of countless sermons. "Reader's Digest" reprinted it some years ago from the "Presidio," a paper of the Iowa State Penitentiary. The editors consulted libraries and prominent theologians to determine its origin to no avail.

On our mailing list was an advertising agency executive who sent our greeting to his mother, who was 98 years old. The message seemed familiar to her and in looking through her late husband's sermon notes, she found the original. He had been a Methodist minister in Scranton, Pennsylvania and had written "One Solitary Life" as part of a Sunday sermon. The chaplain at Iowa State Penitentiary had arranged with Rev. Peck to use the same sermon notes and the Scranton pastor obliged each week.

We thought the foregoing was an interesting development in the solution of a mystery and wanted to share it with you at this time . . . rather than discourse on the problems of our industry, labor, the cold war and the world.

May the Christ who was born in Bethlehem, who went about doing good, only to be crucified on a cross for the sins of the world, live in your heart today and in the days to come.

Vincent C. Hogsett

Publisher

INGREDIENTS AND KNOWLEDGE...

Ingredients and knowledge, two of the most important factors in manufacturing abrasives appears in all Mid-West Abrasive products. The highest grade of bonds and grains, combined with the skilled workmanship of the Mid-West engineers can guarantee the highest quality wheels, hones, belts and specialty items.

Mid-West Abrasive Company offers a complete line of quality abrasives for all your abrasive needs. Every item in this line is produced with consistent high quality and is delivered on time. Mid-West also provides the skill of abrasive engineers to help you with present applications, new set-ups or quality control.

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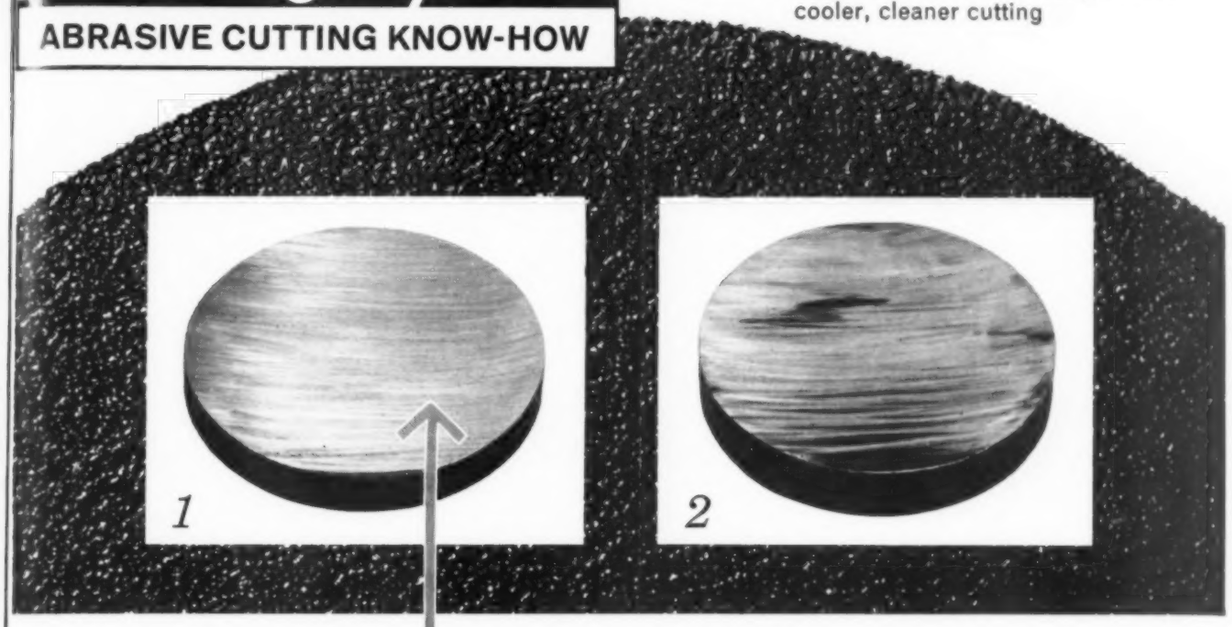
Allison-Campbell

ABRASIVE CUTTING KNOW-HOW

Close-up view of resinoid wheel shows rough texture that provides cooler, cleaner cutting

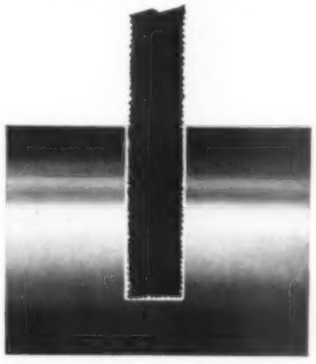


This CLEAN cut was made with a ROUGH-SIDED wheel!

1 · **THE SPECIMEN ON THE LEFT ABOVE** was cut from a 3¾" diameter hardened steel bar in just 28 seconds with an ALLISON *rough-sided* dry abrasive cutting wheel like the one shown in the background. Note that the cut is clean and practically burn-free.

2 · The specimen on the right was cut under the same conditions and with a wheel of the same formulation, but *without* rough sides. The result—the cut took 30 seconds and produced a badly burned surface.

3 · The secret is the extra clearance the rough sides give *inside* the cut (as shown in the small picture at right), and the resulting *cooler* cutting action. This adds to wheel life, too. That's why, for the dry abrasive cutting of solid bars, heavy-wall tubing and structural shapes, ALLISON-CAMPBELL field engineers generally recommend rough-sided wheels.



3 Inside the cut, rough-sided wheels give extra clearance, extra cooling for faster cutting and to prevent burning

For dry cutting of thin-wall tubing with minimum burr, a fine-grit, *smooth-sided* wheel is the choice. And for *wet* abrasive cutting, dozens of ALLISON wheel specifications are available to match the material you are cutting, the quality you require, and the cut-off machine you use.

Regardless of your cut-off problems, your ALLISON-CAMPBELL field engineer can help you choose the wheels that will give the results you want. He is an abrasive cutting specialist—use his know-how.

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ACCO

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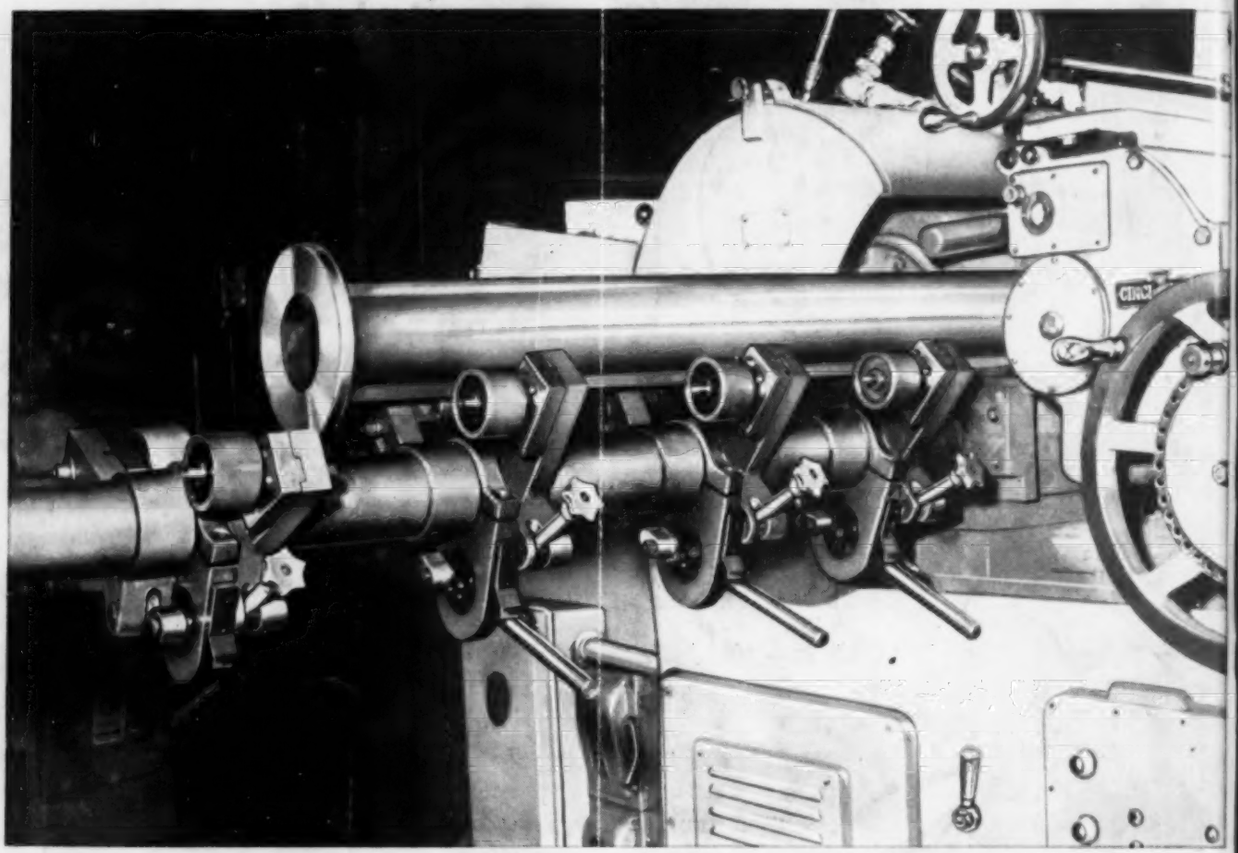

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